SCIENTIFIC AMERICAN

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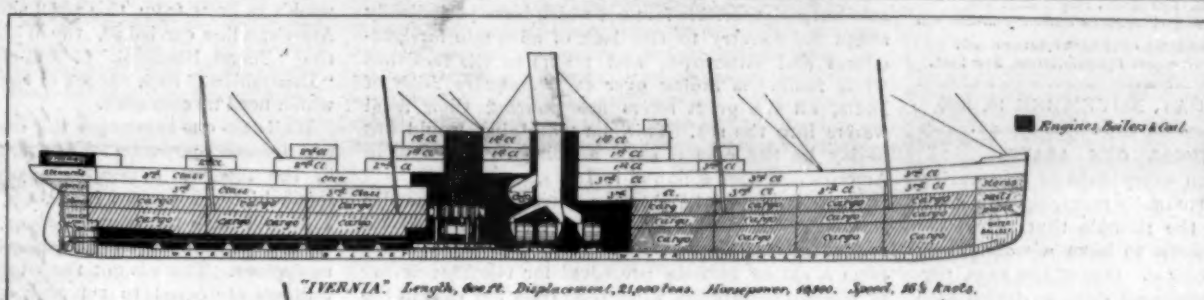
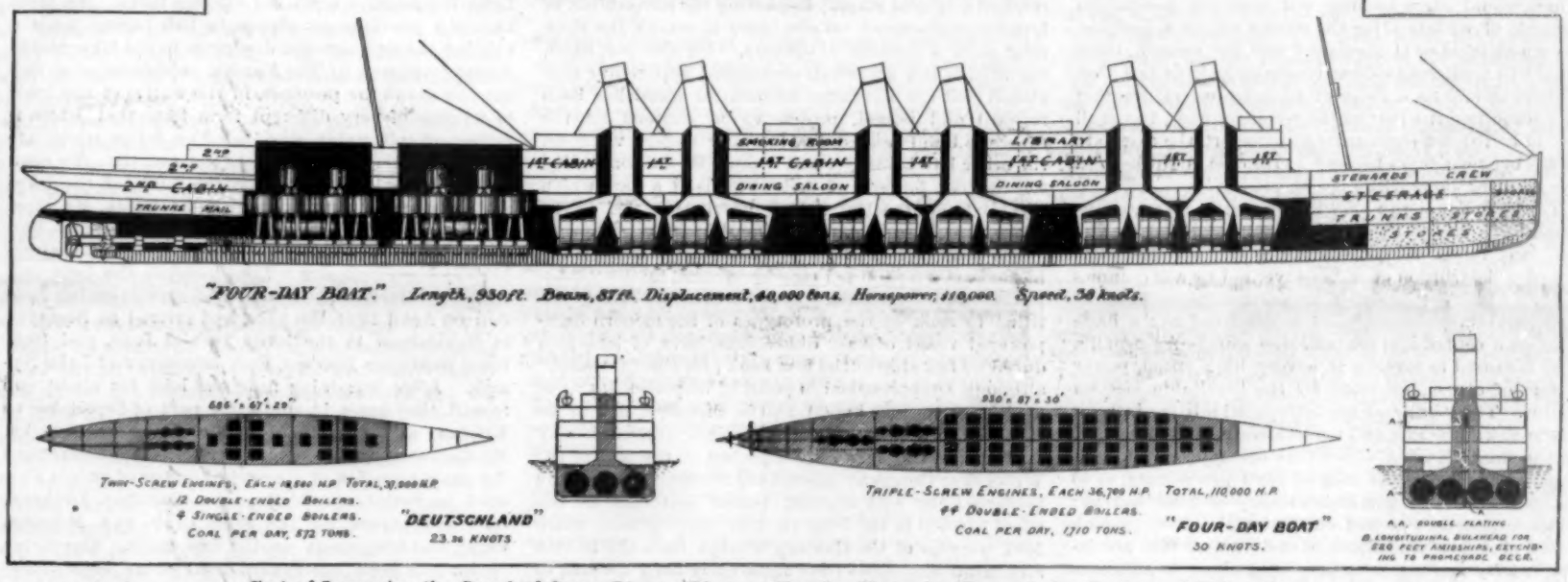
ATLANTIC STEAMSHIPS—PRESENT AND FUTURE.

The development of the transatlantic steamship has reached a point at which it shows a decided tendency to follow along two widely divergent lines. On the one hand we have the fast, high-powered express steamer, carrying only mails and passengers, in which the customary cargo space is monopolized by engines and boilers; while sharply distinguished from this is the vessel of large cargo and passenger capacity, but of moderate speed. Of the latter type the "Ivernia," of the Cunard Company, is the latest and largest representative, while the Hamburg-American liner "Deutschland" is the latest and fastest and most extreme of the high-speed passenger ships.

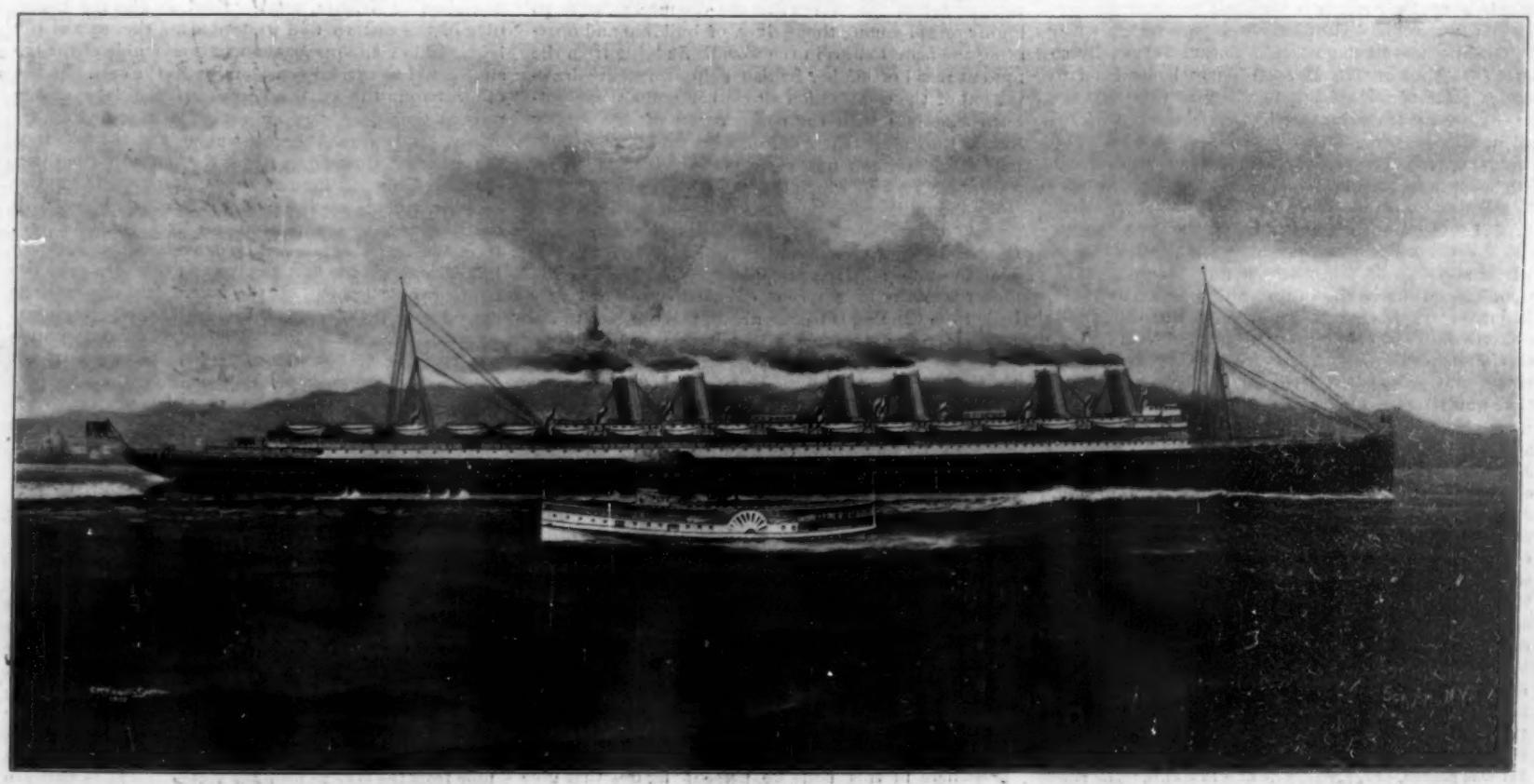
It is claimed by

(Continued on page 294.)


Engines, Boilers & Coal
"IVERNIA." Length, 600 ft. Displacement, 21,000 tons. Horsepower, 18,300. Speed, 18½ Knots.
"DEUTSCHLAND." Length, 686 ft. Displacement, 23,000 tons. Horsepower, 37,000. Speed, 23.36 Knots.



Cost of Increasing the Speed of Ocean Liners—Diagram Showing Excessive Demands for Engine and Boiler Space.



A Four-Day Transatlantic Liner?

ATLANTIC STEAMSHIPS—PRESENT AND FUTURE.

Scientific American.

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THAT CENTRIFUGAL GUN AGAIN.

It would seem as though every field of engineering had its particular and perpetually recurring monstrosity, which, in spite of the ridicule that invariably greets its reappearance, seems to have a wonderfully tenacious hold on the inventor. One of the most persistent of these is the centrifugal gun, a device with which it is attempted to hurl projectiles into space in somewhat the same way as a boy throws a stone from a sling. Only a few years ago an illustration went the rounds of the press, showing a huge disk which was to be rotated at unheard-of speeds by means of a steam engine, with pulleys and belt attachment, and which carried on its periphery a series of steel shells that were to be automatically released at the critical moment, and were to start on their tangential flight with a velocity of so many thousand feet per second. Apart from the physical impossibility of making a disk which would carry holding and releasing mechanism capable of withstanding the strains due to a peripheral speed of several thousand feet per second, these would-be artillerists evidently overlooked the fact that if there should be a delay of an infinitesimal fraction of a second on the part of the releasing gear, the shell would be thrown rearwardly into the fort, the casemate or the between-decks battery, as the case might be, and the gunner "hoist with his own petard."

The centrifugal gun idea is apparently by no means dead, for a recent issue of so staid a journal as The London Times devoted about a half column to a detailed description of a gun invented by a Mr. James Judge, which is "intended for battleships, earthworks and garrison purposes," and is described as "a huge slug on a centrifugal-fire machine gun." As usual, a disk is caused to revolve at a very high speed, power being, of course, provided by the inevitable electric motor. The "bullets" are introduced into the interior of the disk at the axle and travel along curves which lead to the circumference, where they are impelled through a barrel at the modest rate of 3,000 per minute, or 50 per second. With a muzzle velocity of 2,000 feet per second, penetration was effected through a $\frac{7}{16}$ inch plate placed at a distance of 400 yards. We are informed by our contemporary that there is no excessive heating of the gun, because of the continuous stream of cold air which is impelled through the barrel by the motion of the disk. It is bad enough when a journal whose technical information is usually so correct as that of The London Times lends itself to such a piece of self-evident humbug as this; but the case is even more aggravated when a technical journal in this country, which is devoted to naval and military interests, gravely repeats the story with manifest belief in its possibilities.

AMERICAN ENGINEERING METHODS FOR THE DEVELOPMENT OF INDIA.

In a supplement to an article published in Blackwood's Magazine on the subject of irrigation in India, Major-General F. C. Cotton, of the British army, shows not only how the country will be rescued from periodical famines and enriched by the water of its great rivers, wherever that water is carried, but at the same time how irrigation will enhance the value of the railways, on which the government has expended so large a sum of money. Referring to objections raised against a former article advocating extensive irrigation works, on the ground that India is a poor country and cannot afford great expenditures, the writer says that the same objection was held some seventy years ago when engineers were urging the extension of various hydraulic works; and that as at that time it appeared to him that the engineering methods of the United States, where capital at that time was scarce, were better suited to the needs of India than the engineering methods of England, where capital was so much more abundant and more easily obtained, he determined to visit the States and study the problem on the ground. He found that the sections of the States which he visited were financially little better off than India. But although capital was scarce, and credit was at a low ebb, "the rulers were men of unlimited energy and determination, with statesmanlike views of the future."

He quotes the case of the Augusta Railway, which "was approaching completion without a cent of metal money being spent upon it. It could hardly be said that paper money was used, for the notes had no equivalent in money, but were good for so many tons carried so many miles on the railway when it was completed." While the writer disclaims any intention of quoting this fact as a precedent to be followed in India, but simply as "serving to show how difficulties are met by those remarkable people who are still acting broadly upon the same far-sighted policy" in other enterprises, "I must say," continues the General, "that I long to carry such statesmanship as I saw there to the country I love so well in the East." He attributes the terrible famines which have periodically swept the country to the lack of adequate farsightedness and enterprise, and points to the fact that while famine is raging over 440,000 square miles of India, all the great rivers are pouring their flood waters into the sea. This, he maintains, would not to-day be the case if such a policy as he found in America had been followed in India.

There is unquestionably much truth in the candid statements of this army officer. Although the case quoted of the Augusta Railway is one which would form a rather perilous precedent for the financiering of modern enterprises, there is no question that in the main the writer is correct; for although what he calls the far-sighted policy which has governed the development of the natural resources of this country has in many cases been productive of temporary disaster, there is no question that to the daring methods pursued by the early promoters the wonderfully rapid industrial growth of this country is largely due.

STEAMSHIP COMPETITION ON THE ATLANTIC.

As far as the question of speed is concerned, the development of the fast transatlantic steamship has reached a critical stage. Regarding the advisability of building high-speed vessels, there is, among the shipping men, a division of opinion. On the one hand, the British and American companies, apparently convinced that the maximum economical speed has been reached and passed, profess to be content for the future to build vessels of 20 knots or under; while, on the other hand, the German companies are continuing to bring out larger and faster vessels at a rate which was never approached in any previous period in the history of the transatlantic steamship.

The English companies, after having developed the high-speed liner to the stage represented by the "Campania" and "Lucania," boats which are clearly entitled to rank as the prototypes of the modern high-powered vessel of vast dimensions, have of late produced no fast ship of the first rank; for the "Oceanic," although unapproached in point of displacement, is of moderate speed (20 knots), and is, therefore, not to be reckoned in the present consideration. Indeed, it may be said that this vessel was a protest on the part of the White Star Company against the tendency to cram the modern liner with engines, boilers and coal in the effort to keep in the front rank of competition. Since 1893, the year of the Chicago World's Fair, the British steamship companies have apparently been content to drop out of the race, and yield to their younger competitors across the North Sea the distinction, once so highly prized among themselves, of building and operating the fastest ships in the world. Judging from the present trend of affairs, British ship-owners are drawing out of the competition altogether and are contenting themselves with the construction of less showy but, as they persistently affirm, more profitable vessels, half cargo and half passenger, of the "Ivernia" type, a sectional view of which is given elsewhere.

We should be more inclined to believe these oft-repeated assertions as to the unprofitable character of the modern express steamship, were it not for two considerations: In the first place, as the London Engineer remarks in a recent editorial, we heard very little from the English press about the dangers to the passengers and the financial loss to the shareholders entailed in running high speed vessels until the Germans made their wonderfully successful venture with the "Kaiser Wilhelm," a vessel which not only easily outdistanced her competitors, but has been a strong drawing card, to judge from the standpoint of the passenger agent, with the traveling public. In the second place, the fact that the North German Lloyd Company, after three years' experience in running an expensive vessel of this class, should have deliberately placed an order for two larger, more powerful and much more costly boats, involving an outlay of, surely, not less than $7,000,000, is to us proof positive that the "Kaiser Wilhelm," at least, has not proved a losing venture. It is true, as the English journals point out, that the German subsidies given to these vessels are liberal, but it is absurd to suppose that they are sufficiently generous to cover the deficiency on such an enormous investment of capital as will be involved in the production and maintenance of these new ships. Elsewhere in this issue we present figures that give good reason to assume that the latest and most costly of these vessels is far from being a losing venture, the full passenger lists, the high prices paid and the frequency of the round voyages, enabling the vessel to roll up a balance to her credit during the summer season that must more than offset the deficiency during the winter months, and this without taking into consideration the postal subsidies.

A most important consideration, and one to which competing companies cannot afford to shut their eyes, is the world-wide prestige which accrues to the line that can run a 23-knot boat on a 3-week schedule with something of the regularity of railroad service. The fame of such a vessel attracts a large amount of travel that otherwise would find its way through other channels. Thus, an inquiry into the statistics of a recent week's sailings from this port showed that while the American line carried 90, the White Star line 60, and the "Fuerst Bismarck" 55 first-class passengers, the "Deutschland" took out 281 in the first cabin.—figures which need no comment.

While no one begrudges the credit which is due to the German companies for having figured so brilliantly in the modern development of the transatlantic steamship, we cannot but hope that the American Line will have the courage to order a couple of fast boats which will surpass all others in speed and accommodations. There is not the slightest doubt that our builders are equal to the task of constructing such ships, and judging from the success which has attended the "Lucania" and "Campania" and their successors of the German lines, we do not doubt that these vessels would be a profitable investment.

LAKE TANGANYIKA EXPLORATIONS.

An English explorer, Mr. J. E. S. More, who is one of the members of a scientific expedition sent to the lake regions of Central Africa, has recently made a report to the Geographical Society of London; one of the most important points is the rectifying of the position of Lake Tanganyika upon the existing maps. Mr. More had, in a previous expedition to this region, made a number of soundings and dredgings in the lake, and in a note presented to The Journal of Microscopical Science he shows the presence, in the waters of this lake, of a fauna of very different form from that which is typical of soft water, and including forms which are identical with those of the Jurassic earths. To complete these observations upon the fauna of the lakes and the general configuration of the region, Mr. More made a second trip, accompanied by Mr. Malcolm Fergusson, who was especially charged to study the structure of the mountains which bordered the lake and with the cartographic work. The expedition left London on April 19 of last year, and arrived at Blantyne in Nyassaland in the latter part of June, and from there passing to Zombaa, Fort Johnston and Lake Nyassa. After remaining near the lake for about one month, they came in the latter part of September to Ktiotua, at the southern end of Lake Tanganyika. Mr. Fergusson has taken by astronomical observations the exact situation of a certain number of points situated on both banks of the lake, Soumbou, Loukega, and two others on the west bank and Msamba, Oujiji and five others on the east bank. The sketch which has been established from these co-ordinates shows that if the southern part of the lake, from Soumbou to Ktiouta, remain fixed, as also the beginning of the eastern and western sides, the axis of the lake, and in consequence the whole ensemble of the basin, should be carried considerably to the east. On the other hand, the outline given to the lake at the present time does not appear to be modified appreciably. It is toward the central part of the lake that the greatest differences from the admitted position appear. This position has been determined from measurements made by Capt. E. C. Hore, combined with the longitude of Oujiji as found by Lieut. Cameron. It is the latter explorer who traversed the region in 1874–75 and was the first to give an exact idea as to the hydrographic system of the lake. His observations agreed with the opinion of Livingstone, who supposed that the lake emptied into the River Loualaba. Cameron was the first to establish with certainty that it belonged to the basin of the Congo, by the discovery he made of the River Loukouga, which proceeds from the west bank of the lake. It is an affluent of the Loualaba-Congo, but it is only an intermittent outlet of the lake, as it is sometimes obstructed by a dam of sand and débris which stops the outflow of the lake and causes its level to rise. This explorer fixed the longitude of Oujiji at 29° 59' 30" east, by lunar observations, which comes close to the figures recently obtained.

The present expedition visited the mouth of the Loukouga where it joins the lake; the mountains, which are very high along the western coast, decrease gradually from Mtova, on the right bank of the river, toward the north, and also from Temboni to the southern extremity of the lake. The entrance of the Loukouga forms a kind of delta of sand, where the water flows in several small streams which unite about a mile from the lake to form the river; this flows between banks of soft and sandy earth, 50 to 100 feet high. The mountains, which are lower to the north of the river,

increase in height near Ouvira, to the northwest of the lake; they reach a height which Mr. Fergusson estimated to be 8,000 feet. These mountains form a range parallel to those of the northeastern side, whose height is also quite considerable. From Lake Tanganyika Messrs. More and Fergusson proceeded to Lake Kivou, which was first seen in 1894 by the German Lieutenant Von Goetzen. Mr. Sharpe and the German Doctor Kandt, who have recently explored that region, say that the position of Lake Kivou is very badly laid out on the maps. The present explorers climbed the volcano of Karounga, which is in activity; it lies on the north bank of the lake. They proceeded then to Lake Albert Edward, and arrived about the middle of February at Fort Gerry, having decided to make the ascension of Mount Rouenzori, which has an altitude of 17,600 feet. It is the principal peak of the mountainous region which rises between the Lakes Albert and Albert Edward.

CATHODE RAYS.*

BY P. VILLARD.

The passage of the electric discharge in gases produces luminescent phenomena easily observable at pressures of the order of one millimeter of mercury. In a tube provided with electrodes the discharge gives the following appearance. A violet-red luminous column starts from the positive toward the negative electrode, but stops before reaching the latter, ending at the dark space of Faraday. It is deflected by a magnetic field; as the pressure is reduced, the column increases in volume, but becomes more feeble and disappears. On the contrary, the luminosity at the negative electrode envelops all or part of the electrode, being violet in color (yellow in oxygen, pink in hydrogen). As the rarefaction increases, it enlarges and covers all the surface, increasing in thickness; at the exterior it ends at the dark space and at the interior it is separated from the cathode by an equipotential surface, the interior space being relatively dark. In immediate contact with the cathode is a layer of pinkish light, visible only at high vacua.

ELECTRIC RESISTANCE OF DISCHARGE TUBES.—The gaseous medium is not to be compared with a conductor; the current passing in it is discontinuous and not regulated by Ohm's law. It is not comparable to an electrolyte. The law connecting the current intensity with the difference of potential is not known exactly, but below a certain tension the gas acts as a perfect dielectric, while above that point a discharge is produced and the current increases with the tension; 300 volts is the minimum for the discharge.

BEAM OF CATHODE RAYS.—In a spherical or ovoid bulb provided with a cathode in the form of a concave mirror, the negative light is voluminous and fills the bulb, the dark space extending a few millimeters from the cathode, and a luminous cone is formed, which becomes more distinct as the vacuum increases. The cone is the trace of the beam of cathode rays in the residual gas; scarcely visible in the dark space, it becomes brilliant farther out; its color is violet in air, pale yellow in oxygen. As the vacuum is increased, the cone changes to a cylindrical beam starting from the center of the cathode. The cathode rays are propagated in straight lines, and cross without interference.

PHENOMENA OF PHOSPHORESCENCE, ETC.—M. Villard points out the well-known effects produced upon the different bodies, especially the alkaline earths and phosphorescent screens, and recalls their propagation in straight lines, as demonstrated by the shadows cast by bodies placed in the path. The mechanical effects of the rays are shown in turning radiometer vanes, etc. The calorific effects are strongly marked; according to the action produced upon a fragment of diamond, M. Moissan estimates that the temperature thus reached 3,600° C. An object encountered by the rays becomes a source of Roentgen rays. As to the chemical effects, M. Goldstein has discovered that the haloid alkaline salts become colored and their phosphorescence diminishes; chloride of sodium becomes brown, and bromide of potassium blue; the colors disappear slowly in the dark and rapidly in the light. Messrs. Wiedemann and Schmidt have found that the salt acted upon has an alkaline reaction; Messrs. Elster and Geitel find that they possess the photoelectric property in a great degree, and part with a negative charge under the action of violet light. These reactions indicate a reducing action on the part of the rays. If the shade of an obstacle is projected upon a sheet of copper oxidized at the surface, the copper is here reduced to the metallic state. When the rays encounter the air, ozone is produced, as M. Lenard has shown.

The deviation of the rays by the magnet is well known; the deviation diminishes with the pressure, or as the tension rises. Its direction is determined by the laws of charged bodies. M. Villard shows the calculation of this deviation, which has been made by Mr. J. J. Thomson. If e is the charge, m the mass, and if the speed, v, is small compared with that of light, the calculation shows that $\frac{e}{m}$ is a constant and independent of the nature of the gas.

ELECTROSTATIC DEVIATION OF CATHODE RAYS.—The enlargement of the shadow of a wire united to the cathode or to the ground has been observed from the beginning by Mr. Crookes and others, but the question has only recently been made clear by the experiments of M. Majorana and M. J. Perrin. A beam of parallel rays traverses an anode of wire gauze and casts the shadow of a wire upon the walls. A static machine has one pole joined to the gauze and the other to the wire; when the wire is charged negatively, the two half-rays which it forms are separated, enlarging the shadow; a positive charge brings them together, and they may even cross, showing them to be attracted by a positive and repelled by a negative charge. Two beams of cathode rays have no reciprocal action upon each other, as has been shown by Wiedemann and Ebert, Bernstein and the author. The absence of mutual action does not imply absence of electrification; it suffices to admit that the particles in movement follow each other at distances which are great compared with their radius of action.

The fact that the rays are propagated in straight lines shows that even near the anode the electric field is too weak to have a sensible action upon them. Experiments show that the field is very intense near the cathode, but very weak in the rest of the tube. As to the speed of cathode rays, the attempts at direct measurement made by Mr. J. J. Thomson and M. Majorana have not been conclusive. Mr. Thomson has made a series of calculations by an indirect method. If m is the mass of the particle, e its charge and v its velocity, the result of the calculation shows that the value of $\frac{m}{e}$ varies from $1{\cdot}1 \times 10^{-7}$ to $1{\cdot}5 \times 10^{-7}$; and that it is independent of the nature of the gas. The value of v lies between $2{\cdot}2 \times 10^{9}$ and $3{\cdot}6 \times 10^{9}$ centimeters per second. M. Wiechert has determined the velocity by a direct method, and finds the value of v between $5{\cdot}04 \times 10^{9}$ and $3{\cdot}96 \times 10^{9}$ centimeters per second. It is thus of the order of one-tenth the speed of light.

ELECTRIC AND MAGNETIC DISPERSION.—M. Birkeland has shown that a cathodic beam may be decomposed by a magnetic field into several distinct beams unequally deviated. This experiment, made with a beam passed through a slit and a magnetic field parallel to the slit, gives upon a fluorescent screen a veritable cathodic spectrum. The number of rays is variable with the conditions of experiment. M. Deslandres has formed a spectrum with an electrostatic field placed perpendicular to the slit. It is found that these beams unequally deviated correspond to different potentials, and they must, therefore, be emitted successively.

The experiments of M. Lenard are of great interest. He has studied the rays outside of the tube; for this he uses a tube whose end is formed of a thin sheet of aluminium. The rays passing outside are soon diffused in air, but in a rarefied gas he obtained a cone of rays three feet long. M. Lenard shows that the rays render the air a conductor of electricity, provoke the condensation of supersaturated vapor and ozonize the air.

SECONDARY EMISSIONS.—M. Goldstein has observed that if a tube has narrow places or elbows, these emit cathode rays at the side of the anode. When a perforated paper screen is placed between the anode and cathode, each hole becomes a center of emission. An isolated metallic sheet, struck by the rays, emits secondary rays, which are always perpendicular to the surface.

PASSAGE OF THE RAYS THROUGH METALLIC SHEETS.—Hertz has shown that very thin metallic sheets allow the rays to pass. According to Lenard, glass 0·2 millimeter thick is also traversed. Mr. J. J. Thomson and the author consider that the transmission is not real, but that secondary rays are emitted. Another series of experiments have been made by M. Goldstein. If a tube is divided into two parts by a cathode having several openings, beams resembling cathodic beams are observed in the part of the tube opposite the side of the anode, these leaving from each of the openings in the cathode. These new rays have been given the name of "Kanalstrahlen" by the experimenter; they are peculiar in not being deviated by an electric or magnetic field.

NON-DEVIABLE RAYS.—Mr. J. J. Thomson has found that only a part of the cathode rays are deflected by the magnet. If the vacuum is such that the rays start only from the center of the cathode and are visible by the illumination of the residual gases, it suffices to approach a magnet to show that a part of the beam is unacted upon and continues in a straight line. These rays illuminate the residual gases, but seem to have no action upon phosphorescent bodies.

NATURE OF THE RADIANT MATTER.—The phenomena of reduction already pointed out with many chemical compounds is obtained either by the cathode rays or the "Kanalstrahlen." If at the same time it is remarked that the cathodic phenomena are independent of the nature of the gas and that the relation $\frac{e}{m}$ is invariable, one is brought to admit the unity of the radiant matter. Hydrogen, however, is the only simple gas known which has a reducing action, and it is precisely this gas whose spectrum is always and often alone visible in the cathode layer. This element has special properties, such as the power to traverse metals heated to redness. While waiting for another simple reducing gas to be discovered, the hypothesis may be considered as acceptable that hydrogen constitutes the radiant matter.

* Lecture delivered before the Congress of Electricity, Paris Exposition. Abstract prepared by special Paris correspondent of the SCIENTIFIC AMERICAN.

PURIFICATION OF GASES.

In the course of a lecture delivered before the English Institution of Civil Engineers, Dr. C. H. Wedding described the purification of noxious gases at the Kotterbach iron mines in Upper Bohemia. The ores obtained in this locality are richly impregnated with carbonates, and they are roasted before their conveyance to the blast furnaces, for the purpose of liberating the carbonic acid. By this means, an economy approaching 33 per cent is effected in the cost of freightage. This district, in addition to being a rich iron mining center, is also a profitable agricultural country. In fact, agriculture is quite as important as the iron mining. It was discovered that the driving off of the sulphurous and mercurial vapors during the roasting was detrimental to the welfare of both the animal and vegetable life in the vicinity. An attempt was thereupon made for the purpose of purifying the noxious fumes before their dissolution in the atmosphere, and a condensing plant was installed. Two timber towers, each three stories in height, have been erected. The floors of the buildings are thickly set with blocks of limestone. At the summit of each tower is placed a large tank of water, from which a steady spray, equal in area to the whole surface of the floor, is constantly running. The gases upon their exodus from the ores in the roasting process are conveyed to the bottom of the first tower, and ascend against the stream of water through the floors to the top of the building. The cool spray deprives the gases of their mercury and compounds, and arsenic and antimony compounds, also a portion of the sulphur oxides. That part of the sulphur oxide which is not freed from the gases by the water displaces the carbon dioxide of the limestone, forming sulphites and sulphates of lime. The gases in their semi-purified condition are conveyed from the top of the first tower to the bottom of the second structure, and the process repeated, after which they escape into the air, and have been found in this purified state to have no effect upon either the cattle or crops. The cost of running this condensing plant is defrayed by the recovery of the mercury, which is collected in settling ponds, purified, and sold.

DEATH OF MAX MÜLLER.

Prof. Friedrich Maximilian Müller, Corpus Professor of Comparative Philology at Oxford University, died October 28. He was born in Dessau, Germany, in 1823, and after attending the universities at Leipzig and Berlin received his degree in 1843. He early showed a great fondness for philology and the languages of the East. He studied Arabic, Persian and Sanskrit, and visited several countries to study manuscripts. In 1848 he settled at Oxford. His rise in the university was rapid, and he was elected a Fellow of All Souls College in 1858. The university intrusted to him the editing of a series of translations of the sacred books of the East and fifty volumes have been issued. He published a large number of the most important works and papers upon Oriental languages, and he received many honors from foreign universities and courts. To some extent he outlived his reputation, and he held a much higher place in the estimation of British scholars a quarter of a century ago than he held in recent years.

The theory with which he is most closely associated in the public mind is that the cradle of the Aryan languages must be looked for in Central Asia; this view no longer commends itself to most students of the subject.

OYSTERS IN EUROPE.

Vice Consul-General Hanauer writes from Frankfort under the date September 22, 1900:

The French naval department has an exhibit in the Paris Exposition giving a graphic view of the development of oyster cultivation in France. During 1879–1887, the yearly average production of French oysters amounted to 11,000,000 francs ($2,123,000), gradually increasing to 20,500,000 francs ($4,825,000) for the year 1898, when 15,500,000 French and 3,000,000 Portuguese oysters were sold along the French coasts. The bivalves are a great luxury in Europe, and so dear that only the wealthier classes can afford to eat them. In the city of Frankfort, small German or Dutch oysters in the shell cost from 60 to 72 cents (2½ to 3 marks) per dozen. Some resident Americans occasionally have a barrel of American oysters sent by their friends at home. The shipment of our oysters in cold storage would be practicable and afford profit.

New Type of Battery.

A somewhat remarkable form of storage battery, which may be also used as a primary element, has been recently patented by M. Ernst Jungner. The peculiarity of the system is that the electrolyte does not vary in composition, nor in its degree of concentration, but the water alone is decomposed. To bring about this action the inventor uses potassium or sodium hydrate, etc., whose metallic bases decompose water. To form the active material of the plates he uses metals whose hydroxyl combinations cannot exist in the presence of water, but are decomposed into oxide and water. The active matter is supported upon plates of metal, preferably nickel or copper, whose oxides are not soluble in alkali. As an example of an element constructed upon these principles, the positive plate is of nickel, pasted with peroxide of silver, mixed with cement to give consistence. The negative is a copper plate upon which has been compressed a layer of finely divided copper. These electrodes are placed together in an ebonite vessel; they are separated only by a layer of asbestos paper, an alkaline solution being used as the electrolyte. A current is formed which is accompanied by the following reactions:

1. $Ag_2O_2 + 2\,KOH + 2\,Cu = Ag_2O + 2\,Cu\,OH.$
2. $K_2O + H_2O = 2\,KOH.$
3. $2\,Cu\,OH = Cu_2O + H_2O.$

The electromotive force of an element of this kind is 0·93 volt. The element may also be used as a storage battery, as upon passing a current into it in the opposite sense the reaction is reversed, and it is ready to begin anew. A less expensive form of cell is obtained by using ferrous oxide at the negative plate and black oxide of manganese at the positive; the reaction then becomes:

$$Fe(OH)_2 + 2\,KOH + Mn(OH)_4 = Fe(OH)_2 + 2\,KOH + Mn(OH)_2.$$

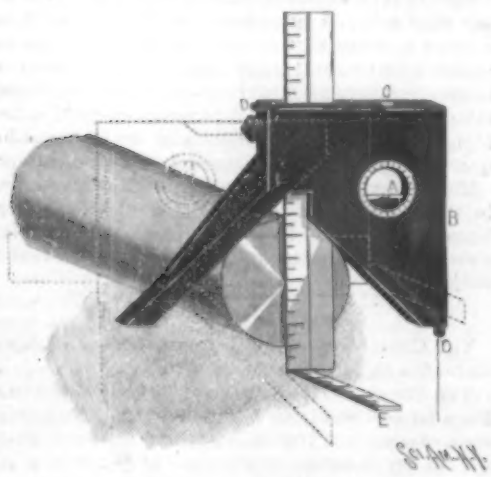
This form of cell is claimed to give a specific energy of 20 to 25 watt-hours per pound of total weight; the internal resistance of this element is very small, owing to the thin layer of electrolyte between the plates, and it is quite durable, owing to the small variation in the volume of active matter during the charge and discharge, as well as the freedom from secondary or local chemical actions. When used as an accumulator, it holds its charge a long time for these reasons, and does not seem to be affected by changes of temperature.

A SQUARE FOR MARKING SHAFT-KEYWAYS.

The illustration which we present herewith pictures a novel square which has been devised by Mr. Armand P. Dubus, of 634 Louisa Street, New Orleans, La., for the purpose of marking keyways on shafting.

The tool comprises a head having two straight edges at right angles to each other and two legs also at right angles to each other. The head is formed with a circular opening in which an adjustable spirit-level, *A*, is held. The straight edges of the head are also provided with levels, *B* and *C*, and with eyes, *D*, from which plumb-bobs can be hung if desired. Arranged to slide through the head so as to bisect the right angle formed by the legs is a 12-inch scale from which an extension, *E*, projects perpendicularly.

When the keyway is to be marked on the end of the shaft, the tool is placed astride the shaft with the spirit-level, *C*, perfectly horizontal. The line is then drawn along the edge of the scale. If it be desired to mark a keyway longitudinally on the shaft, the scale is moved up so as to lie with the extension, *E*, over the shaft.



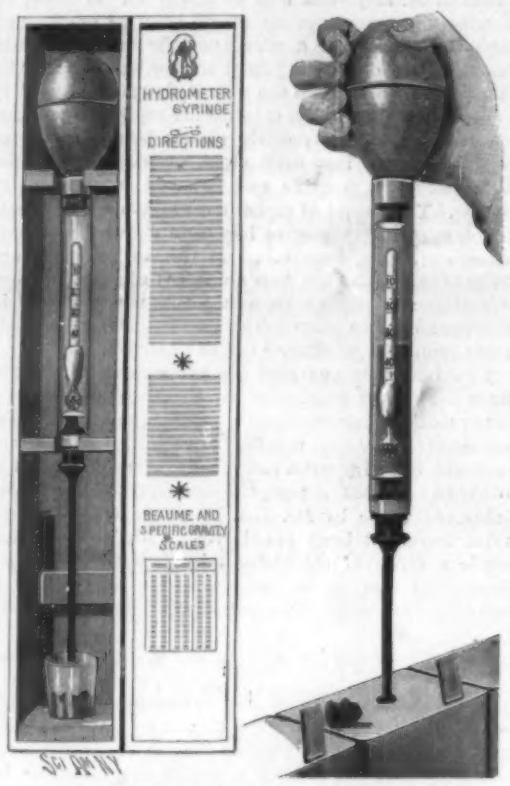
A SCALE FOR MARKING KEYWAYS.

Then, by reading from the level, *C*, the extension, *E*, can be made to indicate the proper line on the shaft. By turning the tool as shown by dotted lines, the reading edge of the scale is horizontally disposed and the horizontal center of the shaft determined as indicated.

A CURIOUS accident occurred recently in a feather bed factory in New York. The feathers got whirling so rapidly that the friction set them on fire.

THE HYDROMETER SYRINGE.

The need of this improvement arose from the fact that the removal of a portion of the fluid electrolyte from a storage battery cell, for the purpose of testing its specific gravity, has always been more or less annoying, disagreeable and unclean, since it has been customary to remove, by means of a syringe, a portion of the electrolyte and put it into a separate hydrometer tube to be tested by the hydrometer, or in the absence



A COMBINED SYRINGE AND HYDROMETER.

of a syringe the solution is poured out from the jar itself into the tube. The accompanying illustration shows a combined hydrometer and syringe which avoids the above described difficulties and provides in one instrument a convenient, cleanly method of adding or withdrawing fluid from the storage battery cells and at the same time, by means of the flotation of the hydrometer within the glass tube of the syringe, permits the specific gravity of the liquid to be quickly and accurately determined.

This is done by compressing the rubber bulb at the upper end (which expels a portion of the air), and inserting the long nozzle in the hole in the cover of the cell, then releasing the bulb, when the liquid rises and floats the hydrometer; the reading is then made, and the fluid returned to the jar by compressing the bulb. Each battery cell may be easily tested in this way and the specific gravity of several cells equalized when necessary by the addition or withdrawal of acid from one cell to another. The syringe, we are informed, has recently been introduced by the Storage Battery Supply Company, No. 239 East Twenty-seventh Street, this city, and is used by the electric vehicle companies.

By means of an additional nozzle having special perforations the filling of the cells with the electrolyte to their proper level above the battery plates is done by first filling the syringe from a supply vessel, then resting the nozzle on the top end of the plates and compressing and releasing the bulb two or three times. The excess above the proper depth is thus withdrawn by the syringe, which is equal to the distance between the perforations and the mouth of the nozzle. The interior bottom and top of the syringe tube is cushioned with rubber to prevent the accidental breakage of the hydrometer as the liquid is expelled.

The hydrometer is provided with the specific gravity and Baumé scale for storage battery use. It is obvious that it may be used for various purposes and with other liquids. When not in use the syringe is placed in a wood box, as shown, in which is a glass tumbler containing an absorbent which holds the surplus drainage of the acid solution. Lying on top of the jar may be seen the usual rubber plug for preventing the spilling of the solution when the jar is agitated. Suitable directions for testing storage battery electrolyte accompany each syringe.

It is a very convenient instrument and is particularly adapted for testing automobile storage batteries, since tests may be made with rapidity and facility.

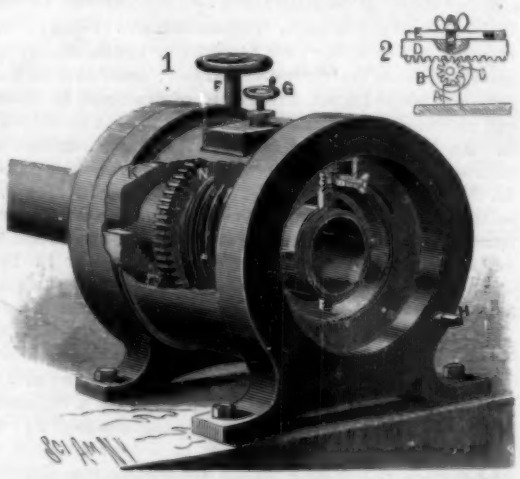
Means of Discovering Living Tissue.

M. Augustus Waller has recently discovered a method of recognizing with certainty whether an organ or a tissue, either animal or vegetable, is living or dead. The action depends upon the following principle: Living matter responds to an electric excitation by a current in the same direction. The same matter, killed by an elevation of temperature, does not respond to this excitation, or gives a contrary current of polarization. This reaction is, according to the experimenter, a positive proof that the matter acted upon is not inert; it is a general phenomenon, and is characteristic of living matter, as has been proved in the case of the muscles, nerves, retina, skin, etc., of animals, and upon leaves, flowers, fruits, etc. The arrangement for carrying out the experiments is quite simple, and may be found in every physiological laboratory. A sensitive galvanometer is necessary; the experimenter uses a reflecting Thomson galvanometer having a sensitiveness such that $1{\cdot}1^{-10}$ ampere gives a deflection of a spot of light equal to 0·1 inch on as cale placed two yards off. A pair of electrodes is connected to the object; any current arising from the object itself is compensated for while the galvanometer is in circuit, so that the latter may be connected or disconnected without producing any effect. The galvanometer is connected to the electrodes of the object and then short-circuited by a plug. The exciting circuit is also connected to the electrodes, and by depressing a key the current is sent into the object. This current is then interrupted and the galvanometer thrown in by removing its plug. If a current comes from the object, its presence is shown by the deflection of the galvanometer. The experiment is repeated with the exciting current in the opposite direction. If the galvanometer responds in one of these cases, the object is living, if not, it is dead. The importance of such a method need not be insisted upon; it may be easily verified by experiment, and the facility with which it may be carried out brings it within the reach of most experimenters.

A PORTABLE THREAD-CUTTING MACHINE.

In an improved portable hand-driven thread-cutting machine patented by Mr. D. Norwood Jerauld, of 26 Whitney Place, Buffalo, N. Y., a novel arrangement of parts has been devised which simplifies the construction ordinarily met with. In a casing a cylinder is mounted, having an exterior thread into engagement with which an adjustable feed-block, *L*, can be moved by means of a handwheel, *G*. To the rear of the cylinder a gear, *N*, is attached, with which an elongated pinion (not shown) meshes. The shaft of the pinion is extended, so that its outer end, *H*, can be engaged by a crank-handle or other suitable turning-tool. A die-carrier is attached to the forward end of the cylinder, which die-carrier consists of an outwardly-extended portion and inner and outer forwardly-extended portions. Dies are movable through openings in the interior flange. Worm-wheels, *B* (top sectional view, Fig. 2) engage the dies, *A*; and pinions, *C*, on the shafts of the worm-wheels engage a ring-shaped rack, *D*, mounted to rotate on the inner flange, previously mentioned. A stop-ring is attached to the outer flange, which stop-ring, as shown in Fig. 2, receives in an arc-shaped slot a pin extended from the rack-ring and provided with a thumb-nut, so as to hold the rack and consequently the dies in adjusted position. The pipe is rigidly held in place by clamping-jaws, *K*, operated by a handwheel, *F*.

When a pipe or rod is in position and the thread-cutting dies are in engagement with its outer surface, the cylinder is driven by the gear, *N*, and the elongated pinion whose shaft is seen at *H*. By its engagement with the feed-block, *L*, the cylinder is compelled to recede, thereby shifting the die-carrier and causing the dies to move longitudinally of the pipe while they are cutting the thread. When the thread is cut, the feed-block, *L*, is raised and the cylinder drawn forward, ready for new work without running back, by its thread



THE JERAULD PORTABLE THREADING-MACHINE.

connections. The jaws, *K*, are "self-centering" devices, since they hold the pipes rigidly in a proper, centered position.

A PIPE line, 142 miles long, has been built to carry Caspian petroleum to the Black Sea. The railroad was inadequate to handle the oil, and it was found more economical to lay the pipe line than to improve the road. At present, however, it must be carried by rail for 400 miles.

THE COLOR TREATMENT OF THE PAN-AMERICAN EXPOSITION.

BY EDWARD HALE BRUSH.

In determining to give color treatment to the buildings of the Pan-American Exposition the management well understood that to create an exposition whose outward aspect should be essentially different from anything of the kind created heretofore would be a task of exceeding difficulty. Indeed, it was felt to be well nigh an impossibility to attain success unless the buildings could be colored. There could not be another "White City." To create one would simply challenge comparison with Chicago's supreme achievement in the Columbian Exposition of 1893, and occasion unfavorable comment rather than the reverse. Color there must be, but how was it to be accomplished? The practical difficulties in the way of giving suitable and artistic coloring to the temporary staff without consuming all the funds of the Exposition in the purchase of paint seemed almost insurmountable. But persistent and intelligent study of the problem has won the day, and in this respect, as well as others, the Pan-American Exposition now bids fair to be a signal success.

MAKING WATER COLOR DRAWINGS AS GUIDES FOR PAINTING THE PAN-AMERICAN EXPOSITION BUILDINGS.

The selection of the Spanish Renaissance style of architecture for the buildings of the Exposition was a fortunate one in view of the need to make unique in appearance and give the exteriors of the structures color. To prepare a color scheme suitable to classic architecture would have been a dubious task, indeed. But with buildings in the Spanish style color is a natural and fitting adjunct and rich, warm tints may appropriately be used in abundance, for they but enhance the beauty of form the structures themselves possess; and with courts and fountains and floral and horticultural effects, such as the Pan-American Exposition will have in profusion, the charm of a setting tropical in its richness is attained. Having determined upon giving the Pan-American Exposition buildings color, the next thing was to find a man capable of putting it on. From the very first the aim of the creators of this Exposition has been to make it on the artistic side a complete and harmonious ensemble. To this end there has been the closest co-operation between every department. Every effort has been made to avoid haphazard work and jarring contrasts. The avoidance of the incongruous and inartistic in the laying on of the color was of especial importance and also of unusual difficulty in view of the fact that there were few precedents to follow, so that he who would achieve success must possess in a marked degree the creative instinct.

In Charles Y. Turner, N.A., president of the Art Students' League, of New York, and a leading member of the National Society of Mural Painters, the Exposition management found an artist who has proved equal to the task. Mr. Turner has had the assistance of other mural painters of national reputation, and the problems to be solved have been studied with the greatest care on both the practical and the artistic side. The accompanying views give the reader some idea of the work that has been going on in Mr. Turner's studio at No. 35 West Fourteenth Street, New York city.

GROUPING THE MODELS OF THE EXPOSITION BUILDINGS—MODEL OF ELECTRIC TOWER IN THE CENTER.

As will be seen from these pictures, a large corps of artists has been engaged in working out from models of the buildings the color scheme of the Exposition in detail. In the first place, the general character of the color plan was determined upon. This was not left to chance or mere fancy, but was studied out with especial reference to the purposes and situation of the different buildings and the character of the whole Exposition.

The Spanish Renaissance architecture is especially adapted to convey the impression of joyousness and festivity. It lends itself readily to enrichment by ornate sculptural adornment and fantastic treatment in both form and color. It gives an opportunity for decorative enrichment of pinnacles and minarets, of arches and colonnades, of dome interiors and the frames of doors and windows, and all this profusion of color, provided it is harmonious and artistic, heightens the pleasing effects, gives striking contrasts, and is in keeping as a whole with the feeling of gayety, of buoyancy of spirits which is characteristic of the pleasure-seeking multitude of a great Exposition.

These colors as laid on at the Pan-American will, in many places, particularly in the pavilions, arches over doorways, and colonnades, give the impression of mosaic work. Other pleasing effects will be produced, as, for instance, the grill work over the main entrances to the Machinery building, which will be colored to resemble bronze. Similar effects will be produced in the principal entrances to other structures.

The color is now being applied on some of the buildings, and some idea can therefore be obtained already of the artistic effects which will be produced. Experiments have been made with all kinds of paint, and an especially prepared oil paint has been adopted which is found, after sufficient trial on the staff work, to hold its color well and stand drying like any other paint. As I have said, the general chromatic scheme is planned with reference to the purposes of the buildings, their situation and the general character of the group. The same is true of the sculpture, produced under the direction of Karl Bitter, and the landscape settings, under the supervision of Rudolf Ulrich.

Mr. Turner's scheme has been to follow out the main ideas of the composition, as the architects and sculptors have been doing. The roofs, as a whole, will be in red, the staff walls tinted in yellows and grays and delicate tones of ivory at varying hues. These light walls and red roofs with heavy foliage banked below and the blue sky above reflected in the interspersed lagoons Mr. Turner calls his primary colors. In this large and comprehensive effect is to be the great picture of the Exposition. The smaller pictures will be discovered in studying the detail.

In general the plan is to have the coloring of the buildings progress in intensity as one enters the Triumphal Bridge in the southern portion of the grounds, where one gets the first comprehensive view of the Exposition as a whole and where one's first impressions of its grandeur are obtained.

In the Transverse Court, the profile of which faces one at the approach of the grounds, there will be the richest coloring. To the left the walls of the Mines, Horticulture and Graphic Arts building will be a warm buff color; the roofs, a medium dark terra cotta. On the right the walls of the Government buildings will be more yellowish. Together these buildings will be the lowest in key in the main vista. In comparison with the rest of the coloring, Mr. Turner calls this crude and strong. From there the buildings on the sides of the Court of Fountains, the main court running directly away from the entrance, will be lighter and more refined in coloring, changing from yellows into grays, the roofs being in hues of lighter reds. First the buildings of Machinery and Manufactures and Liberal Arts will have walls of light yellow and drab or gray, then the Electricity building and the Agricultural building opposite will be of a warm light yellow and French gray. The architectural climax of the Exposition, the Electric Tower, by John Galen Howard, standing at the head of the Court of the Fountains, will strike the highest key of all, being of ivory white with the open work panel on the shaft a broken mass of delicate green, blue and gold. The figure surmounting the tower at a height of 375 feet, the Goddess of Light, will be gilded, and in the rays of the sun will be a dazzling object, visible many miles away.

The accompanying views show how the work of putting on these colors has been studied. Mr. Turner has models prepared of the different buildings, so as to give in miniature an exact reproduction of the entire Exposition. These twenty carefully finished architectural models, each about 15 inches high and on a scale of about one-sixteenth of an inch to the foot, were grouped according to the plan of the Exposition, and upon them and upon other models in plaster, some of which were worked out in most elaborate and perfect detail, the colors are being tried. By comparing the effects of the color upon the models inharmonious results are avoided. Preliminary color studies and experimental treatment of the models prepared the way for the filling in of the details of the general plan and the making of water-color drawings to be used as guides in laying the colors on the staff of the buildings themselves. I say "guides" advisedly, because they cannot be followed precisely, various conditions requiring change in some details when the paint is tried upon the staff in the open air.

In Mr. Turner's studio the blue sky was represented by a painted scroll 8 feet high, and even green shrubbery and trees were reproduced in miniature, so that none of the effects and contrasts of the real Exposition might be lost.

Take as an instance of the color scheme in detail one of the entrances to the Machinery building. These entrances are elaborate in their sculptural and mural enrichment. The general principle followed in laying on the color is to give the columns and relief work light tints and obtain contrasts and a rich effect by darker and warmer hues in the background. Thus, in this entrance the pilars are given an ivory tint, the ornamental bases and capitals of the fluted columns are enriched with golden

background and the main wall at the back is a light soft red, while the arches of the doorways are treated in red, blue, yellow, and other tints to give a mosaic work effect. The cornice of the hood over the entrance will be of brownish wood color. Passing through the entrance and coming to the vestibule, the color will assume an exceedingly rich tone, and the same will be true of the pavilions, which will have elaborate and even gorgeous hues, the colors heightening the effect of the richly ornamented architecture.

Realizing that color is a delicate thing to experiment with, many had expressed the fear that the new departure which has been made in coloring the buildings of the Pan-American would not be a success. From a careful study of what has now been accomplished, it is safe to predict that in this as well as other respects the Exposition which is springing into reality here on the Niagara frontier is going to give the appreciative and discriminating public a most agreeable surprise.

ATLANTIC STEAMSHIPS—PRESENT AND FUTURE.

(Continued from first page.)

the companies which have given up the construction of abnormally fast vessels that they do not, and in the nature of things can not, pay; yet we find on the other hand that the North German Lloyd Company, who have had sufficient experience with the "Kaiser Wilhelm" to judge intelligently of the question, are planning and building vessels that are to surpass in speed and size anything afloat. To assist our readers in drawing their own conclusions, we present drawings and comparative data of the two types of vessels above mentioned.

While the representatives of the companies are naturally reluctant to give exact figures, the data contained in the accompanying table may be relied upon as sufficiently accurate for all purposes. To show how nearly we have in the "Deutschland" reached the limit of economical speed, we have calculated the proportions and leading particulars of a four-day express steamer of 30 knots; and it will be at once evident to our readers that unless some radical change is made in the present methods of producing and utilizing steam as a source of motive power, the 30-knot liner is not likely to get beyond the paper stage.

"IVERNIA."—The "Ivernia" is the latest representative of a type of huge vessels, half cargo, half passenger, which of late years has become very popular, both with the steamship companies and the traveling public. The first of these to visit the port of New York was the "Pennsylvania." She was followed by such vessels as the "Cymric," "Pretoria," and "Grosser Kurfürst," the latest representatives being the "Ivernia" and "Saxonia" of the Cunard Company. As these vessels are of moderate speed, it is possible to give them very full lines, and they are all of great moulded depth, the "Ivernia" measuring 49 feet 6 inches from the keel to the shelter deck.

The speed being only from 14 to 16 knots, comparatively little space and weight has to be sacrificed to motive power; and as the daily coal consumption is only from 100 to 150 tons, a bunker capacity of from 1,000 to 1,250 tons is found to meet all requirements. These vessels are enormous cargo carriers, the "Ivernia" having four cargo holds forward and three aft of the engine room, while above these are two decks, also entirely devoted to cargo. When fully loaded she can accommodate 11,610 tons of actual dead weight, while her measurement capacity at forty cubic feet to the ton is 24,000 tons.

The type is so deep and stable that it is possible, by carrying up the structure of the vessel amidships to an unusual height above the water line, to provide unusual passenger accommodations, the "Invernia" being provided with seven decks in all. Above the hold and the orlop and lower decks, which are given up to cargo, there are three other decks, known as the main, the upper and the shelter decks, which extend entirely from stem to stern. The main and the upper decks are given up to third-class passengers, while the shelter deck is devoted mainly to first and second-class passengers. For a distance of over 300 feet amidships there are two other decks, called the bridge and promenade decks, on which first and second-class passengers are accommodated. There is provision altogether for 160 first-class passengers, 200 second-class and 1,600 third-class, so that in addition to carrying a paying load of 11,610 tons of cargo, this vessel provides for about 2,000 passengers. She burns but little coal, requires but a small engine and boiler-room staff, and hence the running expenses in comparison to her size and earning capacity are very low.

By the courtesy of the managers of the various steamship companies, we have been enabled to compare the average receipts and expenses for several of these big freighters, and we find a remarkably unanimous opinion that the greatest receipts for a single passage of a ship of the type of the "Ivernia" are about $50,000; the revenue from the westward voyages being derived mainly from passengers, and that from the eastward voyages from freight. We have estimated the average cost of one passage at $20,000; figures which go a long way to explain the popularity of these vessels with the shipowners.

	Displacement in tons.	Horse power.	Speed.	First cost.	Coal burnt per day, tons.	Bunker capacity, tons.	Cargo capacity, tons.	Passengers. First.	Passengers. Second.	Passengers. Third.	Crew.	Estimated maximum receipts for full ship, one passage, exclusive of mails.	Cost of one passage.
"Ivernia"	21,000	10,500	16·50	$1,625,000	150	1,250	11,610	160	200	1,600	250	$50,000	$20,000
"Deutschland"	23,000	37,000	23·36	3,300,000	572	4,500	900	450	300	300	550	*143,000	50,000
Four-day liner	40,000	110,000	30·00	6,200,000	1,710	9,550	None.	800	450	250	750	295,000	80,000

*Actual value of passenger fares on a recent westward trip.

"DEUTSCHLAND."—In the "Deutschland" we see the latest development of the high-speed liner. From whatever point of view she is regarded, she has been such an unqualified success that she lends herself admirably to the present comparison. She is not only the fastest and the most powerful, but, by virtue of her coal consumption of 1·45 pounds per horse power per hour, including auxiliaries, she is considerably the most economically-driven big vessel afloat. Compared with the "Ivernia," she is 86 feet longer, has 2 feet 6 inches more beam, and 5 feet less moulded depth. Her working draught of 39 feet is probably about a foot less, and on this draught, in spite of her much larger dimensions, she displaces only 2,000 tons more than the former vessel, the comparatively small increase in displacement being due to her yacht-like lines. The diagram which we herewith present of the ship shows more strikingly than any mere description at what an enormous sacrifice we obtain a speed of over 23 knots an hour; for here we find that the cargo space, which in the "Ivernia" has a capacity of over 11,000 tons, is in the "Deutschland" entirely appropriated by the engines, boilers, coal bunkers, machine shops, and stores which go to make up a motive equipment of 37,000 horse power capacity. The comparison preaches an eloquent sermon on the text that in the same vessel "resistance increases as something more than the cube of the speed." The larger displacement of the "Deutschland" is partly compensated for by her finer form; yet in raising the speed from 16·5 to 23·36 knots, the horse power has to be increased from 10,500 to 37,000, while the coal consumption runs up from 150 to 572 tons per day. So completely does the motive power fill up the hold that the cargo capacity is reduced to 600 tons, this amount being the maximum that she can carry. As a matter of fact, the "Deutschland" usually carries no cargo, ten tons being, we believe, the most she has ever taken aboard. To keep the enormous aggregate of machinery in motion requires the services of 240 engineers, oilers, stokers, etc., and the whole ship requires a crew, including the engineer's staff, of 550 men. The carrying of cargo being out of the question, the four decks above the boiler room are given up entirely to passengers, of whom she can carry 450 first-class, 300 second, and 300 third-class.

The running expenses of such a vessel are necessarily enormous. To take one item alone, the coal, we find that the cost, for the six days from New York to Hamburg, assuming an average price of $4.50 per ton, is about $15,500. In addition to this, and even more costly, are the fixed charges against the vessel, the most serious of which are the depreciation and the interest on first cost, which cost in the case of the "Deutschland," amounted to $3,300,000. It is customary to reckon depreciation in the case of these fast boats at 10 per cent of the first cost, and this for the reason that as soon as they are exceeded in speed by other vessels, they quickly lose their popularity and therefore their earning power. Moreover, the hard driving to which they are subjected induces a more rapid deterioration than occurs in slower vessels. Probably the fairest way to reckon depreciation on such high-speed vessels is to assume it as 10 per cent until half of the cost has been covered, and then reduce the rate to five per cent. Depreciation and interest, coal, wages of the crew, cost of provisions, dockage, tonnage dues, insurance and other items will bring up the total cost of one passage of the "Deutschland" to $50,000.

Does such a vessel pay? Popularly, it is supposed that she does not; but the experience of the "Deutschland" during this her first season gives reason to suppose that she is certainly not a losing investment. The popularity of these very fast boats enables the companies to receive correspondingly higher prices for accommodation; as a matter of fact, we know that on a recent westward run of the "Deutschland" the total passenger fares taken in amounted to $143,000, and the fares on the return passage brought up the total for the round trip to over $200,000, this sum representing the receipts from passengers alone, without taking into consideration what was received for carrying the mails. Since the cost of running the boat for one round trip, including fixed charges, is $100,000, we see that a profit of about $100,000 was realized in the space of three weeks. It must be remembered, however, that these figures represent the best voyage, and the receipts will not be so high throughout the rest of the summer season. Judging from these figures, it is likely that while for six months of the season she shows a profit, for three months of the year the "Deutschland" will only about make her expenses, while for the other three months she will probably be in dry dock and refitting for the next season's traffic, during which period the fixed charges will be accumulating against her. Altogether, it is likely that if only a moderate proportion of the heavy subsidies earned be taken into account, placing the boat in this respect on the same basis as her English and American competitors, the "Deutschland" will show a creditable margin of profit in the year's service. Over and above this there is to be reckoned in the world-wide prestige which undoubtedly accrues to the line which owns the fastest vessel.

FOUR-DAY LINER.—As to the possibilities of the future, it is evident that with our present form of hull and type of motive power, we have nearly reached the limit of economical speed. To drive the "Deutschland" at 30 knots would require about 83,000 horse power, two and a quarter times as much as she now possesses. The accompanying diagram proves that if Scotch boilers and slow-revolving engines were provided in the design of a 30-knot "Deutschland," it would be impossible to put into her shell more than one-half of the necessary amount of power. Evidently to secure 30 knots a larger boat would be required, and a larger boat means increased power to drive the increased weight. The increase in power, however, would not be directly proportional to the increase in the displacement, the longer ship being ton for ton easier to drive, because of the refinement of her lines due to her greater length. Nevertheless, by the time we have designed a boat large enough to carry the power corresponding to a speed of 30 knots, we shall have upon paper the mammoth ship represented in our drawings. She will be 930 feet over all, 87 feet in beam, and 30 feet in draught, and will displace about 40,000 tons. Engines of 110,000 horse power would be required, and even if triple screws were used, it would be necessary to develop 37,000 horse power on each shaft—a task that would stagger the best of the world's engine builders of to-day. Forty-four double-ended Scotch boilers would be required to supply the steam, and during each day's run of twenty-four hours 1,710 tons of coal costing $7,700 would have to be fed into the 352 furnaces. It would require 7,900 tons of coal to carry the vessel to Plymouth and 8,550 tons to take her to Hamburg, the cost of the fuel alone being $38,000. The ship would have to stow 9,550 tons of coal in her bunkers for a single trip across the Atlantic.

To anyone who has watched the reverse bending strains to which a ship like the "Deutschland" is subjected when she is being driven across the Atlantic seas, it is evident that we have come to a point where it will be necessary to give increased longitudinal strength to any vessel that exceeds the present length of 700 feet. In a four-day liner this might be provided for by running a longitudinal stiffened bulkhead, extending from the keel to the promenade deck, through the vessel between the after engine-room and the forward boiler-room bulkheads. The vessel might be further strengthened by carrying up the side plating to the promenade deck, which is placed one deck higher than in the "Deutschland," and by doubling the plating at the bilges and at the promenade deck, as shown in the midship section of the ship.

In conclusion, it is safe to say that such a vessel as this will never be built. We shall cross the Atlantic in four days, but not with a vessel of this type. The higher speed will be attained, not by multiplying engine and boiler weights, but rather by multiplying pressures and speed, and utilizing every refinement in the way of economizers, superheaters and feed-water heaters, as is being done by Mr. Mosher in his 40-knot craft, the "Arrow," described in our last issue of the SUPPLEMENT. If a 30-knot transatlantic steamer makes its appearance within the next few years, it is safe to say that it will be driven by the combination of water-tube boilers, using hot, forced draft, with fast-running reciprocating engines, using superheated steam, or with turbines of the Parsons type. So great will be the reduction of weights and saving of space achieved by this change, that it will be quite within the possibilities to produce on a displacement not much greater than that of the "Deutschland" a 30-knot ocean steamer that shall have equal accommodations for passengers.

An Italian of Pinerolo has succeeded in reaching the top of Colle di Sestrieres, 6,670 feet above the sea.

Science Notes.

Dr. Edward R. Squibb, the veteran chemist, died October 26, in his eighty-second year. He was appointed a surgeon in the United States Navy shortly after his graduation from Jefferson Medical College, and subsequently became surgeon in charge of the Brooklyn Navy Yard. During the Civil War he resigned from government service and became a manufacturing chemist. He devoted a great deal of his time to scientific experiments.

Another curious bog slide, similar to that which happened a year or two ago, has recently occurred in Ireland, near Lisdoonvarne in northwest Clare. The bog in question was several acres in extent, and its movements are adduced to the heavy rainfalls with which the district has been visited. The direction that the bog moved was toward a lower-lying valley, and it dashed over the intervening country with terrific velocity, completely demolishing a dwelling house and destroying two persons who were in the place at the time. The semi-liquid mass also wrought considerable damage to property during its progress.

Signor Cantalamessa, the director of the Venice Academy, has recently made a valuable discovery in that city. One day he chanced to visit the home of a poor man and was impressed with two dirty, ill-looking oil paintings. Closer inspection of the subjects convinced him that they belonged to the Italian Renaissance period, and he offered the owner the sum of $20 for the two pictures. The latter of course was absolutely unaware of the intrinsic value of the property, and he immediately accepted the offer. The Director took the pictures away and cleaned them. One was found to be a "Holy Family" by Titian, and the other by Bassano. It was only a short time ago that a valuable Rubens was similarly unearthed in a strange place in London.

Dr. Letts, the Professor of Chemistry at the Belfast College (Ireland), in collaboration with his colleague, Mr. Hawthorne, has discovered that sea weed is a valuable test for ascertaining the presence of sewage in sea water. His attention was directed to this subject by the large quantities of sea weed outside Dublin and Belfast that were putrefying. The two chemists thereupon determined to discover the reason of this extensive putrefaction of the weed, and protracted investigations proved that the successful growth of the weed depends almost entirely upon the presence of sewage in the water. The greater the pollution, the more prolific was the growth of the weed, while, on the other hand, if no pollution of the water existed, the weed simply died. Prof. Letts communicated the results of his experiments in this matter to the chemical section of the British Association.

The coffee-growing industry in tropical Africa is developing tremendously. The seed was introduced into the country about five years ago by some English missionaries, who conveyed a few beans from Kew with the object of ascertaining whether the resources of the country were favorable to the culture of the article. Judging from results, the ground appears peculiarly adapted to the industry, since last year 100 tons of coffee were exported from Uganda alone, and the result of this year's production will be even greater. Blantyre coffee is generally contended to be the finest in the world, even excelling the famous Mocha. It is greatly in demand in England, but unfortunately up to the present the supply is very limited. The great difficulty with which the growers have to contend is the imperfect means of transporting the article from the plantations to the sea. This difficulty, however, will be overcome to a great extent by the construction of the Uganda Railway.

The chemical composition of the atmosphere differs but little, wherever the sample may be taken. The London Lancet considers that the favorable effect of a change of air is not due to the change in the proportion of gaseous constituents. One important difference, however, is the bacteriological one. The air of high altitudes contains no microbes, and is in fact sterile, while nearer the ground they are abundant. In the air of towns and crowded places, not only do the microbe impurities increase, but other impurities are found, such as the products of combustion of coal, etc. Several investigators have found traces of hydrogen and certain hydrocarbons in the air and especially in the air of pine, oak and birch forests. It is these bodies, which doubtless consist of traces of essential oil, to which the curative effects of certain health resorts are ascribed. Thus the vicinity of a fir forest is said to give relief in diseases of the respiratory tract; but these traces of essential oils and aromatic products must be counted, strictly speaking, as impurities, since they are not apparently necessary constituents of the air. Recent analyses have shown that these bodies tend to disappear in the air as a higher altitude is reached, until they disappear altogether. It would therefore appear that microbes, hydrocarbons and entities other than oxygen and nitrogen, and perhaps argon, are only incidental to the neighborhood of human industry, animal life, damp and vegetation.

Engineering Notes.

Acetylene gas headlights are being tried on the Atchison, Topeka and Santa Fe Railroad.

Work is progressing rapidly on the Theatre Français, Paris, and the masons have finished their work.

Acetylene safety lamps are used to a considerable extent in Germany. In a form which has been patented the closing cover of the calcium carbide container is arranged so that it is only possible to open the chamber containing the flame after the removal of the cover, and, therefore, extinguishing the flame.

The British naval authorities are going to raise new 100-ton shear legs within six hours at the dockyard at Portsmouth. The two upright legs are each 175 feet in height, while the hind legs extend to a height of 220 feet. The legs are connected at the top by a huge pin weighing 3 tons. The legs are to undergo a severe test when erected, and for this purpose they will carry a weight of 150 tons for the space of two hours over the large basin 60 feet from the wall of the dock.

While a new era has dawned for the sailing ship in this country, in England this craft is rapidly falling into desuetude. During the three months July, August, and September, out of 177 vessels which left the stocks in the English ship-building yards, only six were sailing vessels. At the present moment there are only 29 sailing vessels in course of erection in Great Britain, against 423 steamers. The sailing vessels most in demand are those of 100 and 200 tons, while there are only two vessels of 3,000 tons in hand.

The Gas Light and Coke Company, of London, are experimenting with a view to enriching their gas with petroleum, and for this purpose they have just received a huge consignment of oil from Borneo. One very salient feature in connection with this purchase is the fact that an economy of 25 per cent in cost was effected by having the oil from Borneo, instead of from America or Russia, notwithstanding the fact that the cargo had to be brought a distance of 9,000 miles. Another noteworthy fact is that the vessel which conveyed the oil to England was driven the entire distance by means of oil fuel. From these experiments it would appear that the difficulties which have generally been met with as regards the use of liquid fuel at sea have been obviated.

Herr A. Borsig, the well-known engineer of Berlin, is exhibiting at the Paris Exhibition a railway locomotive which he has constructed for the Prussian State Railways. The distinguishing characteristic of this engine is that it is provided with a superheater which contains more than one-fifth of the total heating capacity of the engine. This engine is the third of its class, and in it are embodied all the improvements which the experiments with the other two locomotives proved would be desirable. The experiments with the two previous engines demonstrated that this superheater is capable of raising the temperature of the steam, which has a pressure of 175 pounds to the square inch, to 626° Fah. The superheater is fixed in close proximity to the boiler, so that initial condensation is obviated and a great economy thus effected.

So successful has been the Blackwall tunnel in offering a means of communication between the north and south banks of the River Thames, that the arrangements are being rapidly advanced for the construction of a similar subway between Rotherhithe and Shadwell. This new tunnel will be one-quarter of a mile in length, and will extend from Rotherhithe on the southern bank to Shadwell Station on the northern bank. It will tap very thickly populated districts on both sides of the river, and will be even more useful than the Blackwall tunnel. The population that will be served by the scheme numbers 626,987 persons. The County Council proposes to expend $4,233,750 for the acquisition of the necessary land giving entrance to the subway from each side, etc.; while the total cost of establishing the communication will be $10,000,000, of which sum $7,000,000 will be expended upon the actual boring of the tunnel and approaches.

It will be remembered that some months ago an enthusiastic French engineer, M. Berlier, conceived the idea of constructing a submarine tunnel beneath the Straits of Gibraltar, thus bringing the coasts of Spain and Morocco into railway communication. The tunnel was to somewhat resemble that which was projected many years ago in England, by which Dover and Calais were to be connected. M. Berlier's project, like that of the English engineers, did not receive that enthusiastic recognition from the French government which he expected, and the matter was dropped. Now, however, he is reviving the scheme, and is determined that since he cannot secure State assistance to carry through the project he will achieve his ends by private enterprise. He contends that Morocco only wants developing by means of a thorough and efficient railway system to make it one of the richest countries in the world, but that it should be developed under French auspices. He has dispatched some of his own representatives to Fez, in the hope of enlisting the co operation of the Sultan of Morocco to insure the realization of the enterprise.

The Twelfth Census of the United States.

The population by the Twelfth Census of the United States was officially announced by Director Merriam to be 76,295,220, compared with 63,069,756 in 1890; this is a gain of 13,225,464 in ten years, or an increase of 21 per cent. The table given below is approximately correct, although it is subject to final verification. Seventy-four millions six hundred and twenty-seven thousand nine hundred and seven persons reside in forty-five States, the remainder in the Territories, Alaska, Hawaii, etc. No provision was made by the Census for the enumeration of the inhabitants of Porto Rico, but a census of that island taken on October 16, 1899, under the direction of the War Department showed a population of 953,243.

The population by States is as follows:

States.	1900.	1890.
Alabama	1,828,697	1,513,017
Arkansas	1,311,564	1,128,179
California	1,485,053	1,208,130
Colorado	539,700	412,198
Connecticut	908,355	746,258
Delaware	184,735	168,493
Florida	528,542	391,422
Georgia	2,216,239	1,837,353
Idaho	161,771	84,385
Illinois	4,821,550	3,826,351
Indiana	2,516,463	2,192,404
Iowa	2,251,889	1,911,896
Kansas	1,469,496	1,427,096
Kentucky	2,147,174	1,858,635
Louisiana	1,381,627	1,118,587
Maine	694,366	661,086
Maryland	1,189,946	1,042,390
Massachusetts	2,805,346	2,238,943
Michigan	2,419,782	2,093,889
Minnesota	1,751,395	1,301,826
Mississippi	1,551,372	1,289,600
Missouri	3,107,117	2,679,184
Montana	243,329	132,159
Nebraska	1,068,901	1,058,510
Nevada	42,324	45,761
New Hampshire	411,588	376,530
New Jersey	1,883,669	1,444,933
New York	7,268,009	5,997,853
North Carolina	1,891,992	1,617,947
North Dakota	319,040	182,719
Ohio	4,157,545	3,672,316
Oregon	413,582	313,767
Pennsylvania	6,301,365	5,258,014
Rhode Island	428,556	345,506
South Carolina	1,340 312	1,151,149
South Dakota	401,570	328,808
Tennessee	2,020,723	1,767,518
Texas	3,049,398	2,235,523
Utah	276,565	207,905
Vermont	343,641	332,422
Virginia	1,854,184	1,655,980
Washington	517,073	349,390
West Virginia	958,900	762,794
Wisconsin	2,068,963	1,686,880
Wyoming	92,531	60,705
Total (for 45 States)	74,627,907	62,116,811
Indians not taxed	44,617	

Territories.	1900.	1890.
Alaska (estimated)	44,000	32,052
Arizona	122,212	59,620
District of Columbia	278,718	230,392
Hawaii	154,001	89,990
Indian Territory	391,960	180,182
New Mexico	193,777	153,593
Oklahoma	398,245	61,834
Persons in the service of the U. S., stationed abroad (estimated)	84,400	
Indians, etc., on Indian reservations, except Indian Territory		145,282
Total for seven Territories, etc.	1,667,313	952,945
Indians not taxed	89,541	

The following list shows the population of a number of the principal cities of the United States:

Greater New York	3,437,202
[Brooklyn Borough	1,167,582]
Chicago	1,698,575
Philadelphia	1,293,697
St. Louis	575,238
Boston	560,892
Baltimore	508,957
Cleveland	381,768
Buffalo	352,219
San Francisco	342,782
Cincinnati	325,902
Pittsburg	321,616
New Orleans	287,104
Detroit	285,704
Milwaukee	285,315
District of Columbia	278,718
Newark	246,070
Jersey City	206,433
Louisville	204,731
Minneapolis	202,718

A Peculiar Accident.

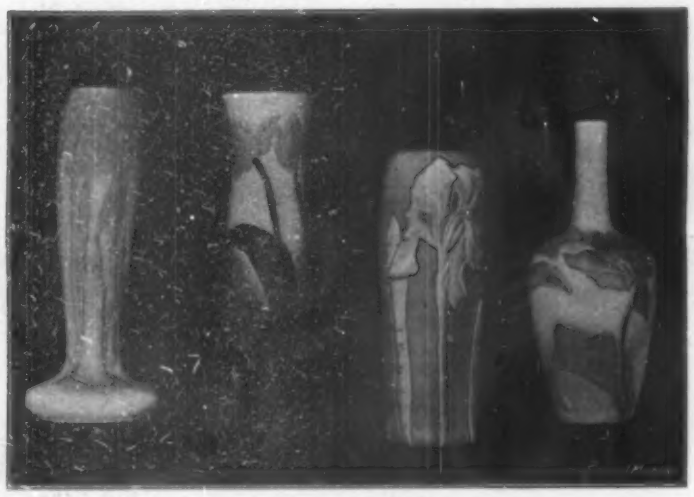
A peculiar accident occurred in a Western town recently. The big iron safe in a shoe factory refused to open, and the bookkeeper and engineer conceived the idea that they could burn out the combination by use of carbon and electricity. It took several hours to accomplish their purpose, but they finally succeeded, but not until they had stood for several hours in the glare of the electric light taking turns at holding the wire and carbon. When the work was over both complained of a dizziness and pain in the head which increased as the hours passed, and in a short time both went suddenly blind at about the same time. All efforts to restore their sight have been unavailing, for while the eye balls appear all right, the sight is destroyed.

THE PRODUCTION OF AMERICAN POTTERY.

BY WALDON FAWCETT.

The announcement of the awards in the ceramic department at the Paris Exposition has served to awaken fresh interest, both in this country and abroad, in a unique institution at Cincinnati, O., which has produced not only in some respects as artistic ware as has been turned out on this side of the Atlantic, but specimens which may be said to be the most thoroughly representative of American ideas and methods in pottery work. The development of the Rookwood enterprise is especially interesting in view of the fact that it is in so full a degree an evolution. Neither at the time of the inception of the project nor for a considerable interval thereafter did there exist in the imagination of any one of the founders or workers any conception of the Rookwood ware as it is to-day known to the art-loving public.

VIEW OF THE WORKS.



FINISHED ROOKWOOD POTTERY.

Rookwood virtually owes its existence to Mrs. Bellamy Storer, a woman of wealth in Cincinnati, who was prompted her to take up the work of which the present plant is the outgrowth in the Japanese ceramic display at the Philadelphia Centennial in 1876. Previous to that time she had painted on china and was especially interested in Japanese designs. It was the enthusiasm which she felt upon visiting the Japanese display, however, which determined her to make an effort to found a pottery in which experiments in native clays by native workers could be carried on with a view to the development of a distinctively American ware.

This pioneer feminine worker and several other Cincinnati women who were associated with her to some extent had done more or less work in over-glaze porcelain decoration; but with a plan for new work laid out, they soon tried other processes of decoration under the glaze. Mrs. Storer's individual experiments in painting the unbaked clay were carried on originally in a pottery where graniteware was made. As the scope of the work gradually broadened, tests were made with all sorts of native clays found in Ohio and Indiana, which demonstrated many of these to be of excellent quality.

The investigators eventually discovered that the heat at the graniteware factory was too intense for firing under glaze; and realizing the disadvantage under which Mrs. Storer was working, her father came forward and offered her the use of a building which he owned and which, after having been suitably refitted, became the original Rookwood pottery. All this time the whole effort was in the direction of artistic achievement and no thought was taken of financial considerations. One important line of experiments in 1877 and 1878 was in the application of color to the wet clay body. The color, diluted with slip—clay thinned with water—was applied with paint brushes as a decoration on the raw clay vase. The idea was to produce a new pottery of native American clays by applying color decoration in the material itself before firing, to make body and decoration a homogeneous mass in the first firing, and then to protect and enrich this biscuit with a glaze.

It may be of interest to note at this point that the name Rookwood which was given to the new pottery was that of a country place in the suburbs of Cincinnati, which was so designated because of the great number of crows which frequented the woods in the vicinity. The first kiln of ware was fired late in 1880; and while attention was given principally to the manufacture of household and table ware from material possessing some of the best characteristics of both the cream-colored and white granite wares, there was always kept in view the ideal of a ware which should possess individuality and be as dissimilar to all existing pottery as possible. For a time breakfast and dinner services, and every imaginable class of ware, from plaques to water-buckets, were produced; but as an increasing degree of attention was given to the artistic development of the enterprise, the printing processes were abandoned, and the table wares were succeeded by the elaborate decorative forms. For all that, it was not until 1889, or nine years after the establishment of the works, that the Rookwood pottery became self-supporting, a circumstance that came simultaneously with the award of a gold medal at the Paris Exposition held in that year.

The present Rookwood pottery was built less than ten years ago, and it is quite as picturesque as the ware produced there. The building, which is perched on a hill that overlooks a goodly portion of the city of Cincinnati, is a large rambling structure in the early English style of architecture. It is of frame construction with tiled roof, and so arranged that the employés may gain the benefit of a maximum amount of light. The equipment of the plant is thoroughly modern in every respect, the kilns being fired with crude petroleum, which insures more satisfactory results. Special machinery is provided for mixing the clay, and there is kept on hand a vast assortment of moulds of all kinds; although many of the most beautiful pieces of Rookwood are modeled by hand, the potter throwing up the clay by means of the old-fashioned wheel.

Practically no machinery, save the primitive potter's wheel, is used at the Rookwood plant in the actual work of manufacture, although, as has been stated, mechanical appliances are relied upon for the preparation of the clays. The men and women whose genius has been responsible for the achievements at Rookwood have always contended that the wholly mechanical processes in molding restricted the variety of outlines in vessels; and, inasmuch as it is desired to have Rookwood pieces in the main variations of classic forms, and to furthermore have each distinguished by individuality of treatment, adherence has been held to the old method of manufacture.

PLACING WORK IN THE KILN.

Although but one thrower is employed at the Rookwood works, he is not only able to work with wonderful rapidity, but he enjoys wonderful creative ability. He passes a piece of ware, when he has completed it to

MOULDING ROOKWOOD WARE.

GLAZE DIPPING.

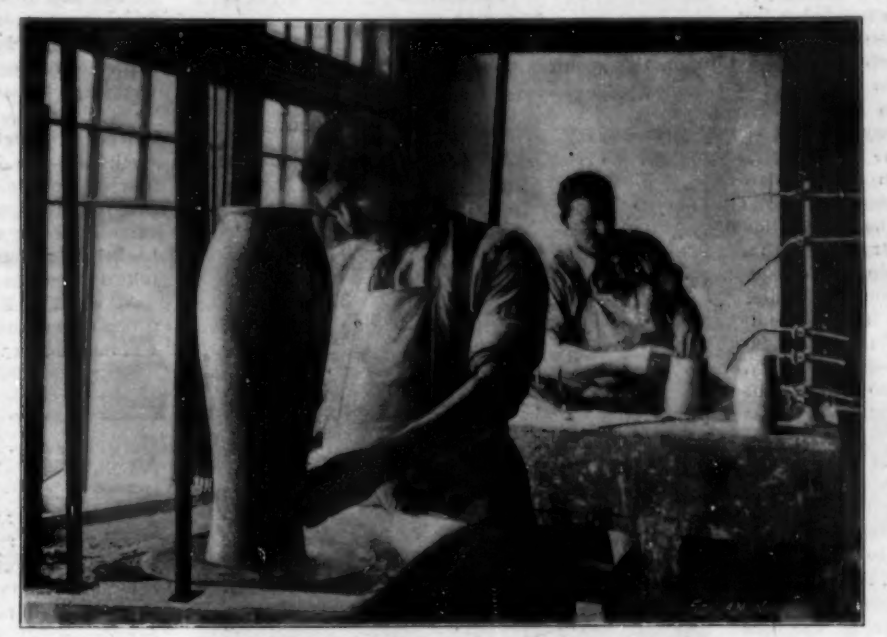
his satisfaction, to a turner, who employs a lathe operated by hand power to carefully trim off the surfaces. The casting method is employed only in the case of certain pieces, such as jars and pitchers which are of standard form, and which must be produced in considerable quantities. Even in this part of the work a method of ancient origin is utilized. The liquid clay is poured into a hollow mold and allowed to stand until the plaster has absorbed the superabundant moisture from the parts in contact. A thin shell of uniform thickness is thus formed and adheres to the mold when the more liquid portion is poured off. When the shell has remained in the mold a short time, it may be removed with safety.

After a piece of ware has been shaped by the potter, or cast in the mold, it is, while still wet, painted with the mixture known as "slip," and then follows a light firing. The pottery specimen, which at this stage is known as "biscuit," has a soft, dull surface. The ware is then subjected to successive firings, and these may radically change its appearance. The workers know that, as a result of this fiery baptism, dull blue may change to gray, and certain shades of green may emerge as pink; but there is always the chance that a wholly unanticipated transformation will take place as the result of some peculiar combination of the metals in glaze and clay effected during the firing. Following the application of the decoration, the piece is dipped in white glaze and sent to the kiln. The firing is, of course, a sort of crucial test, for a running of the colors or a defect in the glaze may play havoc with a specimen which is the potter's especial pride; moreover, there is the danger of breakage always to be considered. From the mixing of the clay to the withdrawal of the completed piece of ware from the kiln, a Rookwood specimen passes through the hands of twenty-one operatives.

The great proportion of the clays used at the Rookwood pottery are found in the Ohio Valley, notably at Buena Vista, Ohio, and Hanging Rock, Ohio, and the predominant shades are red, brown and yellow. Of late the institution has also made use of mixtures from more southerly fields, including a white or cream colored clay from Chattanooga, Tenn., and a clay from Virginia, which, when combined with artificially tinted bodies, gives the wonderful sea-green tint found in much of the Rookwood ware of more recent manufacture.

It would be an error to infer that Rookwood is limited to a warm yellow or red tone, for even dark pieces have often been relieved with deep rich greens and blues, and there has been latterly developed an important series of light arrangements in pale blue, translucent greens, and even some fiery single-color reds. In all of these, however, are found the mellow tone and brilliant glaze characteristic of the ware. The Rookwood products might be divided into three general classes: the cameo, or shell-tinted ware; the dull-finished ware, characterized by the same dainty pink shading into white, but apparently unglazed; and, finally, the richly glazed ware. The distinguishing characteristics of these respective classes are found in the tinting and the blending of colors—effects made possible by the heavy, transparent, colored glazes. Of the various bodies employed, one might be described as genuine earthenware. The principal body in use combines the properties of stoneware and semi-porcelain, a valuable quality, since the object of the artisan is to approach as near as may be to the point of perfect vitrification without endangering the underglaze colors. A piece of Rookwood "biscuit," if well fired, possesses a vitreous ring, infinitely superior to that of earthenware, and will to all intents and purposes hold water, although absorbing the liquid to some extent.

The men and women who have directed the destinies of the Rookwood institution have endeavored in every way possible to cultivate individual artistic feeling on the part of the employés. No mechanical means has been employed in the production of designs, printing patterns being barred absolutely, and no two pieces of ware are alike. All the artists of the Rookwood corps, with the exception of a Japanese, are natives of this country, and most of them have received their art education in Cincinnati. In pursuit of the policy of liberality heretofore mentioned, the conductors of the pottery have at various times sent their decorators to Europe and Japan, and the Rookwood artists are also

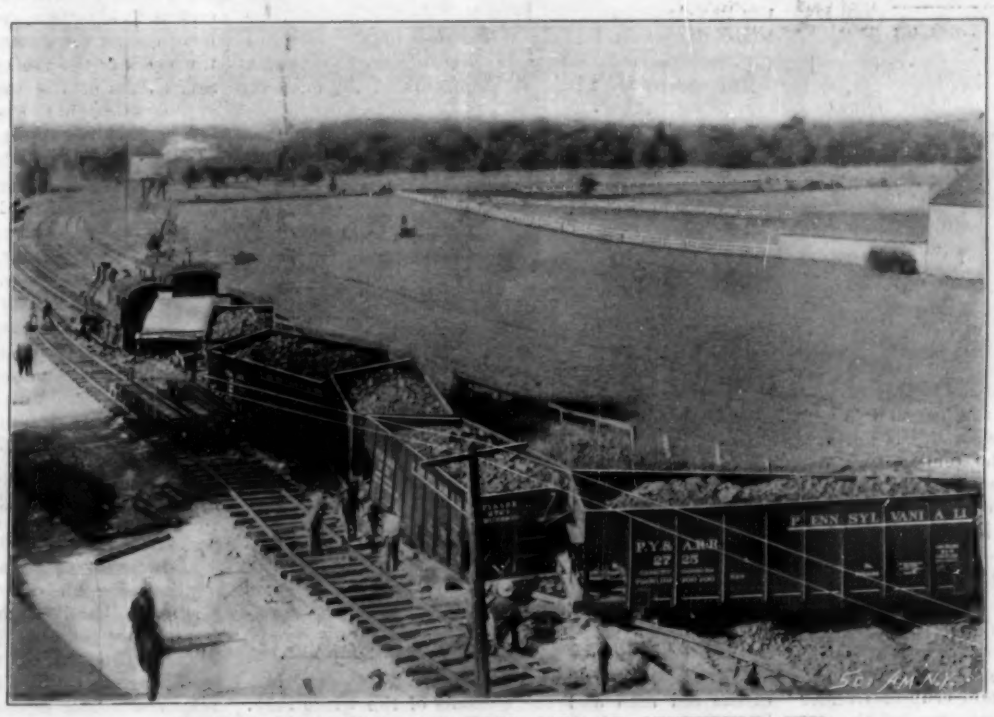


THROWING AND TURNING VASES.

permitted to initiate every piece of work turned out. Fully equal to the opportunities afforded the artists are those presented to the practical potters for the preparation of improved clay for the body, for beautifying the forms, and studying the glazes.

AN ACCIDENT TO A TRAIN OF STEEL CARS.

We present an interesting engraving showing what a small effect a railroad accident has on a distinctively American product—the steel mineral car. The accident occurred on the Youngstown and Ashtabula branch of the Pennsylvania Railroad. Heavy shipments of coal and ore are sent over this road, and, until recently, the old-style wooden car was used on the branch, but finally heavier locomotives and pressed steel cars were provided. Although the road was ballasted to withstand the additional strain, the rails were not replaced by heavy ones, and an accident like the one shown in the engraving is not a rare occurrence. An open switch was, however, the cause of the accident



ACCIDENT TO A TRAIN OF STEEL CARS AT AUSTINBURG, OHIO.

in this instance. A heavily loaded train of thirty or more coal-laden steel cars was passing through the little hamlet of Austinburg, sixteen miles from Ashtabula, and was making good time in order to pass over a heavy grade just north of the village, when an open switch caused the locomotive and five of the pressed steel cars, each of 100,000 pounds carrying capacity, to leave the track. Strange to say, the cars proper were not injured, although the running gear, brake mechanism, etc., was damaged. The main track and the siding were both badly torn up, and an auxiliary track was laid to allow local traffic to pass, but the next morning a train of empty gondolas, in attempting to pass, left fourteen of its number by the wayside, as the auxiliary track was not of sufficient stability to hold them, even at low speed. The steel cars could not be moved until they had been unloaded. Out of nearly thirty thousand pressed steel cars, there has never been one which has been wrecked beyond repair.

Recent Developments in Wireless Telegraphy.

At the recent meeting of the International Electric Congress at Paris, some interesting developments regarding wireless telegraphy were explained. In connection with the possibility of being able to communicate over great distances, M. Willot, of Paris, contended that it was impossible to telegraph satisfactorily over distances exceeding 28 miles, owing to the adverse influence offered by the curvature of the earth.

This contention, however, is disproved by the results of the experiments carried out by Marconi himself, who has been successful in transmitting messages on several occasions over far greater distances than the limit mentioned by M. Willot. Marconi is of opinion that the Hertzian waves follow smoothly round as the earth curves. For instance, the curvature of the earth between his station at Poole, in Dorsetshire, and the station at the Needles, in the Isle of Wight, a distance of about 25 miles, amounts to at least a dip of 500 feet, and yet the messages have not been influenced in the slightest degree. From this result it is apparent that the ether waves follow the curvature of the earth, otherwise the messages transmitted from Poole would travel many hundreds of feet above the station at the Needles.

Captain Tissot does not utilize the ordinary Ruhmkorff induction coil in connection with his wireless telegraphy, but avails himself of a peculiar unipolar transformer invented by M. O. Rochefort. The apparatus comprises the primary coil, but the secondary coil is a single one, that only occupies one-half of the central space. By this means the tension is greater at one pole than at the other, and it is possible to carry on the work with higher electromotive forces.

In relation to the coherers, Captain Ferrié has been conducting several experiments with carbon-metal contacts, which he has found to be more sensitive than carbon-carbon contacts. He has also found them to be preferable to wire and an electrolyte contacts, and that there is a tendency for metal-metal contacts to stick, owing to the current flowing when the apparatus is at rest. He stated that the results of his experiments had convinced him that there is a layer of dielectric between the two points, which breaks down when the difference of potential becomes too high. When the coherers are placed in petroleum they act, but not when they are placed in a vacuum. Should the particles chance to be in very close proximity to one another, then a partial vacuum between them may be produced, through which a brush discharge might pass. It is due to this fact that Captain Ferrié attributes the curious current variations that result from the placing of a lamp carbon upon a cylinder of silver, without any intervention of Hertzian waves.

Another electrician, M. Budde, has devised a method by which vessels can communicate at sea. He places his transmitter in a cylindrical parabolic mirror, which revolves, and by this means radiates the Hertzian waves successively in all directions. The aerial wires are attached to the masts of the vessels. He completely insulates the transmitter and receiver upon each vessel from one another, so that no interference of one with the other may ensue, by means of a commutator which turns synchronously with the transmitter mirror. This apparatus has only been employed over short distances, but the results have been so successful that the method should be subjected to thorough tests over great distances.

Analyses of Egyptian Gold.

M. Berthelot has recently made a series of analyses of Egyptian gold, using the samples which he obtained from M. Maspero, the eminent Egyptologist, who is now director of the Museum of Antiquities in Egypt. M. Berthelot draws some interesting conclusions from these analyses, and has presented the subject to the Academy of Sciences. In the most ancient times, native gold found in alluvial deposits was used directly; it was usually combined with a certain percentage of silver. When this amount exceeded a few hundredths, it took the name of electrum, or asem, among the Egyptians. It is at a much more recent epoch that the silver was separated from the gold and the latter obtained in a pure state. In Lydia, where the first coins were made, this epoch may be fixed by the analysis of the coins preserved in the museums. It is the epoch of Crœsus; the coins of an anterior date are alloyed with silver. The process of separating gold from silver is described by Pliny; it is the cementation by the dry way of the metal in leaves, stratified with a mixture of chloride of sodium and sulphate of iron. The silver is eliminated in the state of double chloride, while the gold remains. This process has been employed throughout antiquity and during the Middle Ages up to the beginning of the sixteenth century, at which time the mints commenced to separate the metals by the wet process, by the methods still used at the present day, and whose description is given for the first time in manuscripts of the middle of the sixteenth century. M. Berthelot found it of interest to verify these inductions by the analysis of specimens of known date, taken from Egyptian tombs. The gold leaves which surround certain mummies seem to be especially adapted for this research; and several of these were obtained from M. Maspero. Their number is, however, too limited to permit of determining exactly the date at which the gold commenced to be completely purified from silver, but the analyses are of interest, in any case. The first was made with gold leaves of the sixth dynasty. Two analyses gave:

Gold	92·8	92·2
Silver	3·2	3·9
	96·0	96·1
Organic matter, etc.	4·0	3·9

Tin, lead, copper, etc., were entirely absent. The proportion of iron is almost negligible. For the second series, gold leaves of the twelfth dynasty were used. These gave:

Gold	90·5	90·0
Silver	4·5	....
	95·0	....
Organic matter, etc.	5·0	....

There is no considerable proportion of other metals. The third analysis was made with gold leaves of the Persian epoch, which gave 99·8 parts of gold. It is observed that the only pure gold is that of the Persian epoch, but as the interval between the two last analyses represents a period of ten centuries, an intermediate series would be useful for comparison.

The New Metallic Alloy Delta—Official Tests.

The associated copper foundries of Lyons and Macon have communicated to the Society of Mineral Industry the results of traction trials undertaken, under the direction of the navy, on the metal delta, says the Moniteur Industriel. The details of its properties are interesting. It is an alloy of copper, zinc and iron. It differs much from brass, both viewed from a mechanical standpoint and with reference to resistance to corrosion.

The tests of pieces designed for the "Casabianca," the "Jemmapes," and the "Valmy" indicate, for the cast metal, a range of elasticity varying from 15 to 18 kil. per square millimeter, and a rupture limit from 35 to 40 kil. with an elongation from 25 to 48 per cent. The diameter of the eprouvettes was 13·6 millimeters; the length was not stated. Heated, the limit of elasticity is not modified materially, at least at the temperature of 215° C. At the same temperature, the rupture charge sinks to 31 to 33 kil. The elongation rises 53 per cent. For most alloys the lengthening diminishes with the temperature.

Rolling extends the limit of elasticity to 30 to 34 kil. per square millimeter, and the rupture charge in the same ratio, which, on rolled pieces, varies from 52 to 75 kil., with an elongation from 20 to 26 per cent. The metal is easily forged at the deep red. At the cherry red, it burns and crumbles under the hammer. At the black, it becomes brittle and cracks. Between these limits, it is as malleable as lead. It is well adapted to stamping, allowing the formation of interchangeable pieces, of which the mechanical qualities are equal to those of the forged metal.

For mines, it presents advantages from its resistance to acid waters. Experiments at the collieries of Bonifacius in Westphalia bbre on the comparison of this alloy with iron and steel. Rolled bars of each of these metals, kept for six and a half months in acid mine water, lost respectively 45 and 46 per cent of their weight for iron and steel and only 12 per cent for the alloy. With an addition of 7 or 8 per cent of sulphuric acid in the water, the alloy does not lose sensibly of its weight in ten days. In particular, it has been employed in mines for timber fastenings and signal cables. The wheels of steam rotary pumps, corroded rapidly by acid waters, have been advantageously replaced with the metal delta.

SIX NATIONS VILLAGE AT THE PAN-AMERICAN EXPOSITION.

BY EDWARD HALE BRUSH.

Indians of the Six Nations' league are now at work upon the grounds of the Pan-American Exposition,

PAN-AMERICAN EXPOSITION—A SENECA CHIEF.

making the bark houses in which they are to live during the Exposition.

It is the purpose of this exhibit to turn back the pages of history several hundred years and show the Indians who then inhabited New York State and the customs they followed. Corn will be ground in stone mortars four hundred to five hundred years old, and bread will be made in the crude way then practised by the Six Nations. For the time being the Indians will discard what civilization has brought them, and live as their ancestors lived, ready for the battle or the chase. The Six Nations Indian exhibit will be of especial value to students, as interpreters will be provided, so that they may talk with the Indians themselves, and ask such questions as they desire concerning the utility of articles on exhibition, or concerning Indian customs.

It is even now possible to see within thirty miles of the Pan-American grounds in Buffalo the ancient customs, dances and other ceremonies of the Iroquois practised much as they were three hundred years ago.

The dances are a strange admixture of the customs

PAN-AMERICAN EXPOSITION—GHOST DANCERS.

of the red man and the customs of the white man. The snake dance, for instance, is performed by red men who wear outing shirts in fast colors of the latest style, golf stockings and russet shoes, and by the Indian squaws who wear the bonnets of a Buffalo milliner.

In some of the dances the leading participants ordinarily dressed in many respects like their ancestors. In the "Feather Dance," Chief Maurice Green, a Seneca, recently wore a buckskin suit with a headdress of horns and feathers. But next to him danced a brave who wore a gauze shirt, which might have been purchased at a Buffalo department store, as a covering for the upper part of his body, knee breeches and long stockings, with bells at the knees, and a figured apron somewhat like that of a Mason. Most of the costumes were more or less fantastic, some typically Indian, others such as may be seen at an American masquerade ball.

The music to which the Indians dance is furnished by rattles formed of turtle shells filled with small stones and grains of corn. With these the Indian musicians beat upon the benches where they sit, and accompany the noise of the rattles by a wild monotone or sing song. It seems to be a point of honor, or an expression of loyalty to tribal custom and religion, for the pagan Indian to take part in these dances, and the aged chief, the gray-haired squaw, and the young mother with an infant in her arms join with the young buck and the Indian maiden in performing them. The pagan Indians predominate on this reservation, and it is the pagan Indians alone who preserve these customs, for it would be regarded as an evidence of backsliding from his faith for a Christian Indian to take any part in them.

At the Six Nations village on the Pan-American grounds next summer the dances and other ceremonies will be produced without the modern innovations.

Four mounds are being constructed on the grounds of the Exposition, near the Six Nations village, to represent the works of the ancient mound builders of North America. One mound will represent the mastodon in Wisconsin; another that designed to portray the serpent swallowing an egg; another the spread eagle mound, and still another, the burial mound. Usually these mounds were in form typical of some animal or object in nature. The burial mound, now completed, shows the burial pit and the cremation chamber and relics in them such as are generally found.

The Carthage of To-day.

A railway now runs to Carthage from Tunis. The summer palace of the Bey may be visited, but superficially. A walk through the courtyards is allowed, surrounded by thickly latticed windows, but one may not stand still within the precincts. Not on the direct road to Carthage, but easily reached during the same drive, is the museum at Bardo, opened in 1888 in the old harem adjoining the Bey's public palace, and full of most interesting results of recent North African excavating. Catalogues can hardly keep pace with discovery and additions, so that of many beautiful things a verbal description by the intelligent attendant comprises all available information. Especially rich in mosaics, the museum contains room after room filled with fine examples of wall and floor decoration, those found in Suza (Hadrumetum) being generally in a better state of preservation than the Carthage remains. The ancient inhabitants would seem to have pleased themselves by reproducing with their bits of colored stone many familiar scenes; and so "fishing," with men and boats and nets, a seashore banquet, quite elaborately worked out, the "chase," with dogs, hunters and flying game, appear. In 1897 a very large pavement design was discovered near Zajhrun, representing the signs of the zodiac in a circle, surrounded by the seven days of the week. In addition to the earlier mosaics, there are many exhibiting Christian designs. But mosaics by no means comprise the chief wealth of the museum. Hundreds of Punic lamps of earthenware are gathered, simple but showing graceful forms and decoration, weird masks with ingenious varieties of contortion in the features, tear vials and water jars, and fine bits of sculpture. Three statues have been recently excavated together at Carthage, perhaps the most beautiful at Bardo. The central figure in this exquisite group is thought to be a Ceres, and is more perfect than the others. A few fine relics in gold and silver are shown, and altogether the Musée Alaoui would be an enthralling spot for months of study.

Blacking Mites.

Frouessart relates in Soc. Biologique the discovery of an acarus inhabiting blacking. On opening an ordinary tin box, simply fastened by a band of paper pasted around the edge, the appearance of the contents was curious; and instead of the ordinary paste which we generally obtain in blacking, there was a friable mass resembling charcoal, on which was pasturing an innumerable host of whitish acari, grouped together like a flock of sheep.

Blacking paste is usually composed of molasses heated to 212°, of vegetable oil, superphosphate, gypsum, and carbon, the last three being the result of the action of vitriol on bone ash. Further, the mass may be sterilized with sublimate 1 to 20,000. The mixture contains at least three substances on which the acarus (Tyroglyphus siro) might feed—molasses, oil, and phosphate of lime. Experience has shown also that the proportion of mercuric salt is quite insufficient to prevent acari, or even molds.

THE PUPPET SHOW AT THE EXPOSITION.

Among the novelties that have been brought together in the "Rue de Paris," which would of itself suffice to justify the name of "big fair" that has been given to the Exposition of 1900, there are few that deserve as much attention as the little theater in which MM. A. and H. Guillaume exhibit their puppets. Here the resources of mechanics, combined with the art of the decorator, have been employed in designing a spectacle far from commonplace. Even in antiquity there were puppet theaters for grown persons, and in the Middle Ages, in the Passion plays, puppets with movable heads and eyes were employed. Under Louis XIV. the puppet impresario was Brioché, who earned about £1,365 in three months' representations at Saint Germain, in the presence of the Dauphin. In the middle of the last century puppets were all the rage, and it was considered fashionable to have puppet exhibitions at one's house. The greatest artists did not disdain to decorate puppets. Some dolls were painted by Boucher, and for them certain pieces were composed especially by Malézieux, of the French Academy. In our own time, about thirty years ago, Mme. George Sand took great interest in the subject, and at her Nohant estate gave representations that were much enjoyed by her guests. The MM. Guillaume, two artists who are well known to every one, are therefore simply keeping alive a tradition. Their puppets, say La Nature, have not only been carved, painted and dressed by true artists, but are so constructed as to resemble living persons through the naturalness of their motions.

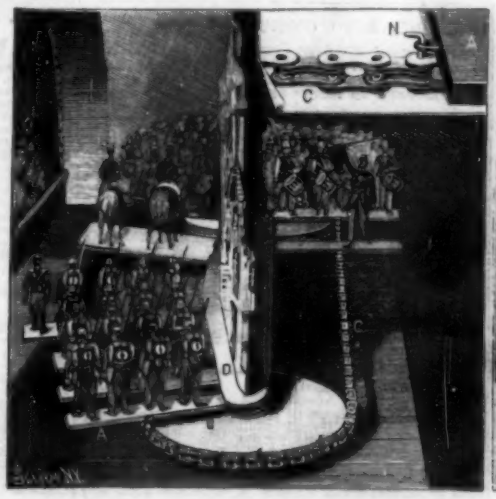


Fig. 2.—AUTOMATIC MARCH OF SOLDIERS.

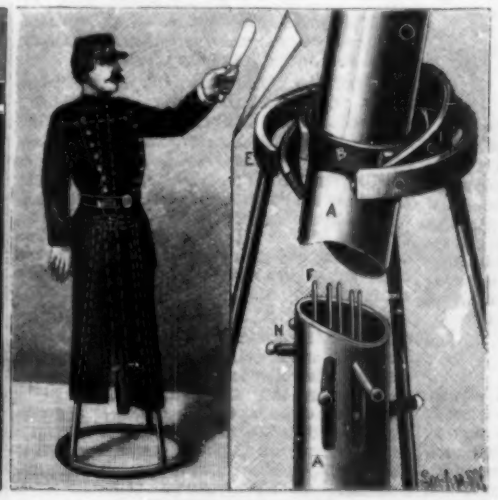


Fig. 3.—MODE OF SUSPENSION AND THE MANEUVERING OF A PUPPET.

The metallic rod, *A* (Fig. 3), by which they are supported, is connected by a universal joint with a tripod, and is kept in a vertical position by a counterpoise, situated at its lower extremity. When placed upon the stage, the arrangement requires no attention whatever. The universal joint gives the rod a flexibility and mobility not to be found in puppets suspended by wires. Through the hollow interior of the rod pass the links, *F*, by means of which the limbs, eyes, mouth, etc., are operated. At the bottom, and near the counterpoise, small hand-levers, *N*, are provided, for the purpose of actuating these links, somewhat in the same manner as the keys of a clarionet are manipulated.

The spectacles are chiefly of a satirical and humorous type, although military maneuvers and fairy scenes are often represented. For certain pieces, there are no less than 200 movable figures and as many dummies. The total number of puppets employed is more than 4,000, about 60 of which, completely jointed, are more especially designed for speaking plays. Each of these figures is then manipulated by a man who is concealed beneath the projecting edge of the stage, and who has his hand upon the handle-lever of the puppet speaking the proper words as he moves the figure. The manipulation requires a certain amount of practice and nimble fingers. The puppet is played, so to speak, as one would play upon a musical instrument. Since the puppets are mounted upon a tripod, the same person can be placed in charge of several of them and pass very easily from one to the other. Certain of them are marvels of ingenuity, and perform motions that are charming by reason of their naturalness. Even those which are designed merely for spectacular effect have been fashioned with the greatest care, and, among these, we may mention especially the cavalrymen, in which the motions of both the rider and the horse are wonderfully true to nature.

The stage is as well equipped as that of a large theater, but not in the same manner, since it has been the desire to avoid the loss of time that occurs through the shifting of the scenes. The scenes are arranged in such a way that they are always in place. Four backgrounds are affixed permanently to a large drum (Fig. 1), which is capable of turning on its axis. It is, therefore, necessary merely to cause the drum to rotate in order to bring to view the scene that is needed. The puppets, isolated or mounted in groups, are arranged all around upon shelves. Some of the pieces are heavy, and would run the risk of being destroyed if they were carried by hand; and so for those that are housed at the lower part there is arranged an elevator, which raises them quickly to the circular floor placed at the level of the stage. As soon as they have passed before the spectators they are lowered on the other side. For the defiling of a regiment, the scenery represents a village with a fort in the distance. In front (Fig. 2) is arranged a traveling road formed of two parallel endless chains, *C*, which are provided here and there with hooks, *N*. Each row of soldiers is mounted on a board provided with rings which engage with the hooks, and all are carried along at the same speed and at the same distance apart. The officers on horseback are arranged in the same way, and the rocking motion which gives them a semblance of life is produced by means of a cam.

The tail end of the regiment, which is descending from the fort while the head is crossing the stage, is composed of silhouettes, mounted upon an endless chain arranged vertically along the frame forming the scenery. One of the scenes includes two changes of view. Electric illumination enables the operator to obtain very happy effects.

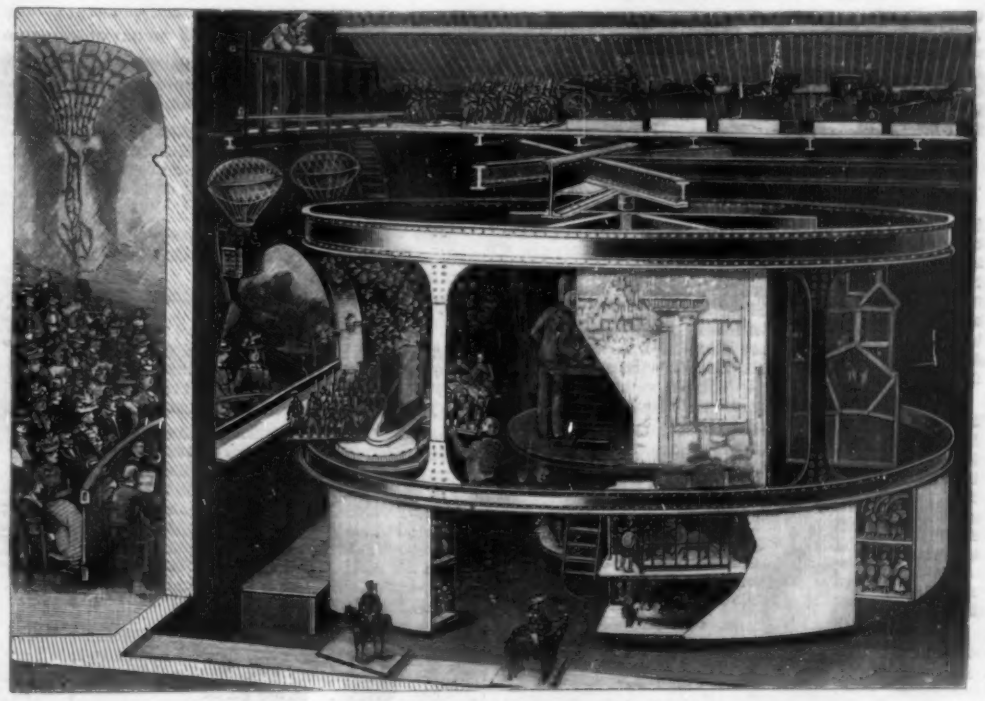


Fig. 1.—THE REVOLVING STAGE OF THE PUPPET THEATER, PARIS EXPOSITION.

A DISCOVERY by the French explorer, M. Paul Gaudin, in Asia Minor, is considered by French archæologists to be an important link in the chain of evidence which unites Greek with Eastern culture, says The Architect. France has for a long time sent various investigators to that region, and among others M. Guillaume, the architect, who afterward had charge of the Louvre, distinguished himself by his researches among the ruins. Near the river Keikus, and not far from Stratonikeia, M. Gaudin has excavated an ancient necropolis. Among the objects found in the graves were a great many which in style and character corresponded with those found by Dr. Schliemann in the lowest strata at Hissarlik, and which were assumed to mark the existence of a city of a much earlier date than the Homeric Troy. The vessels, vases and clay figures were decorated in a similar manner, and the idols were long in form, with engraved lines to indicate the features. The connection between the culture of Asia Minor and Phrygia would thus appear to be further established, not only by the evidence at Hissarlik, but also by discoveries in the eastern parts of Greece and in Cyprus.

Pagodas.

It is not to China only that pagodas are confined, says The Builder's Journal. At Kew Gardens there is a large pagoda. It was erected in 1762 by Sir William Chambers, the architect of Somerset House. His own description of the pagoda as it appears in his work, "The Gardens and Buildings of Kew," is interesting. He says: "The tower commonly called the Great Pagoda was begun under the direction of William Chambers in the autumn of the year 1761, and covered in the spring of 1762. The design is an imitation of the Chinese Taa. The base is a regular octagon, 49 feet in diameter, and the pagoda is composed of ten stories, all of them octagonal in plan. The lowest is 36 feet in diameter, exclusive of the portico which surrounds it, and is 18 feet high. The second is 25 feet in diameter and 17 feet high, and all the rest diminish in diameter and height in the same arithmetical proportion to the ninth story, which is 18 feet in diameter and 10 feet high. The tenth story is 17 feet in diameter and with the covering 20 feet high, and the finishing on the top is 17 feet high, so that the whole structure from the base to the top of the 'Fleuron' is 163 feet." It is not generally known that at Osborne there is a garden cottage in the shape of a pagoda, where none may enter except Her Majesty. This cottage holds nothing but mementoes of the late Prince Consort and relics of the Queen's youth, as well as the toys and games of all her children, many of which the Prince Consort made himself. The pagoda at Pao-tah is the most curious in China, and is regarded with great veneration and respect by the Chinese, for it is the only pagoda on which trees may be seen growing. The Chinese have a leaning pagoda at Ningpo.

November Building Edition.

The November BUILDING EDITION is a particularly attractive number of this handsome periodical. "A Castle of Lauenstein" is accompanied by a plan and interesting engravings. "The New Providence Public Library" is accompanied by two illustrations. A full page is given up to the "German National Pavilion at the Paris Exposition." There are a number of interesting articles in the issue.

The Current Supplement.

The current SUPPLEMENT, No. 1297, has a number of articles of unusual interest. "On the Frontier Near Herat" gives an idea of this strange country. "Poisonous Snakes and Snake Poison" is concluded. "The Commercial Use of Birds" is an illustrated article. "Contemporary Electrical Science" gives ten interesting electrical notes. "The Delphi Collection at Paris" is illustrated by attractive engravings showing the exhibits in place. "Chemical and Technical Education in the United States" is concluded. "Modern System of Teaching Practical Inorganic Chemistry and Its Development" is by Mr. W. H. Perkin, Jr.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CHURN.—James M. Goss, Pekin, Ind. The inventor has devised a simple and cleanly construction of upright churn and driving mechanism readily attachable to and detachable from the churn. The mechanism in question consists of a bevel-gear, the periphery of which is engaged by two bevel-pinions. One bevel pinion is loosely mounted on the dasher-shaft, and the other is rigidly secured to the shaft. By means of this construction, the body of the churn is turned in one direction and the dasher in the opposite direction.

CHURN.—Wickliff B. Mitchell, Owensburg, Ind. To secure a quick forward and backward turning motion of the dasher Mr. Mitchell employs a novel means of adjusting the height of the dash. Arms extend outward from a standard and have forked ends forming bearings for the dasher-rod. A series of annular channels are formed in the rod; and flanges on the forked members of one of the arms engage in any of the channels to support the rod in adjusted vertical position.

PLOW.—John N. Hanna, Del Norte, Colo. The invention relates to a class of plows provided with two shares and moldboards located at opposite beams, and with means for bringing either share and its moldboard in operative connection with a common landside. The invention simplifies the construction of such plows and provides an adjustable beam so arranged that but little strain will be sustained by the handles. The beam is so shaped that large or small sized moldboards can be employed. A turning and locking device for the shares and their moldboards is located within convenient reach from the handle.

Engineering Improvements.

BOILER.—Percy W. Hanford, Oakesdale, Wash. This boiler includes in its construction a vessel having a burner and a regulating-valve controlled by the pressure in the vessel. A water-chamber connected with a water-supply is located over the burner and is provided with an opening at the top for the water to pass into the chamber. The opening also serves for the escape of the vapors. The bottom of the chamber is concaved to form a combustion-chamber for the burner. The boiler, it is claimed, is a good steam-producer and burns little fuel.

Railway Appliances.

TRAIN AIR-SIGNALING APPARATUS.—James H. Turbush, Bronx, New York city. This invention relates to air-pressure brakes of the Westinghouse type, and its object is to provide a train air-signaling apparatus, whereby the separate signal-pipe now used is dispensed with and the train-pipe and its pressure, as well as the engineer's valve, are made use of to actuate the whistle and give the desired signals to the engineer by the conductor of the train, no matter what position the engineer's valve is in.

CAR-FENDER.—Joseph W. McKean, Charleroi, Penn. The fender is mounted to swing by means of a simple and ingenious mechanism. On the car-axle is a gear-wheel engaged by a movable tooth. The movement of the tooth imparts a positive swinging motion to the fender. The object of the construction is to prevent an object on the track from passing under the car-wheels. The arrangement operates automatically.

Mechanical Devices.

COFFEE-MILL.—George H. Drobge, Brooklyn, New York city. The coffee-mill is self-measuring, the construction being such that the hopper can be filled in the usual way and that cut-offs can be adjusted to pass through the slots and separate a certain quantity from the bulk of beans, which quantity alone will be ground. The slots mentioned can be so gaged that each division in the hopper will represent enough beans when ground to make a certain number of cups of coffee of average strength.

ROCK-DRILL FORGING AND SHARPENING MACHINE.—William J. Evans, Butte, Mont. A number of dies are adapted to upset and sharpen the cutting edges of a four-winged drill. A drill-supporting device is provided comprising a horizontal guideway on which a carriage is movable. The carriage can be held at different points on the guideway. A cam-head is held to rock on a pivot-shaft between uprights on the carriage. Handle-arms on the pivot-shaft of the cam-head are adapted by manipulation to rock the cam toward an end of a drill-shank, to feed it up against the impact of the edge-sharpening die.

GRAIN-DRIER.—George Werner, Brooklyn, and John H. Hilliker, Richmond Hill, Queens, New York city. The machine is especially designed for rapidly and thoroughly drying wet grain, such as spent brewer's malt. In the heating-chamber of a furnace drums are mounted to rotate. The drums are alternately inclined in opposite directions and geared together at their converging ends. Boxes are arranged at the ends of the furnace over the projecting ends of the drums. Stirrers are arranged in the drums with their shafts projecting through the boxes and geared together. Mechanism is provided for operating the drums and beaters. A hopper discharges into one of the boxes and is provided with a rotary feed device driven from the stirrer-operating mechanism.

WASHING-MACHINE.—Penton A. Hardwick, Colorado City, Colo. The purpose of the invention is to improve that class of washing-machines provided with means for introducing steam into the washing-chamber, and so to construct the machine that it can be used for drying feathers or clothes or for dampening clothes for ironing. A tub is employed, provided with a double bottom and an outlet and a grating adjacent to the outlet. The outer section of the bottom is eccentric to the inner section. A nozzle leads into the upper portion of the chamber formed by the double bottom of the tub. A double nozzle communicates with this chamber and with the exterior and interior of the tub.

DEVICE FOR FIXING SHANKS OR SCREW-STEMS IN HANDLE-KNOBS OR PICTURE HANGING NAILS.—Seraphin Kuhs, Brooklyn, New York city. This device holds in proper position the shanks or screws of handle-knobs and picture-hanging nails while in process of manufacture, the handle-bodies being formed of molten glass, clay, or any suitable plastic material. The employment of the machine facilitates the manufacture of door or drawer-knobs and insures perfect attachment of shanks or screw-stems thereto. The attached parts project axially from the knob-bodies, which is very important and is not the case when ordinary means for attaching the shanks or screw-stems to knobs are employed.

Miscellaneous Inventions.

CAMP COOKING-STOVE.—William C. Landy, Manhattan, New York city. The invention provides a combined range, cooker, and field-kitchen which simplifies out-door cooking, obviates wastefulness of food and fuel, and tends to minimize danger of scorching. The stove folds up and occupies but a small space and can be readily disconnected. Even the largest size of stove will fit any of the army wagons.

TRUCK.—John Meaney and John Stoever, Ridgefield Park, N. J. It is a common objection that it is necessary in the use of hand-trucks first to move the truck up to the object to be carried and then to tilt the object back upon the truck, whereupon the truck itself is thrown downward so as to bear the load. Before the truck can be thus thrown down, it will invariably jump or move backward. The present invention provides a simple attachment for the truck which will prevent this action.

TENT.—Thaddeus D. McCall, Wichita, Kans. Mr. McCall has devised a convenient and easily-portable tent for campers, which requires no poles, has a canvas floor, and can be suspended and used as a hammock.

ANTISEPTIC BROOM.—Oscar S. Kulman, Savannah, Ga. We have frequently had occasion to notice the various inventions in antiseptic brooms which Mr. Kulman has patented. In this new improvement an antiseptic retainer is inclosed within the wisps of the broom, so that the antiseptic can be fed in sweeping. The end of the broom-handle which enters the antiseptic-retainer is longitudinally bored slightly above the wrappings of wire. At the upper end of the channel thus formed a transverse opening is bored, through which fresh antiseptic can be fed to the retainer whenever it may be desired.

HEATING-STOVE.—Aten B. Howen, Baker City, Ore. By means of a transverse partition the stove is divided into cold-air and hot-air compartments, the partition being formed with an opening near its lower end. In the cold-air compartment is a fuel magazine having its lower end connected with the partition at the opening therein. Below the opening is a fire-pot in the hot-air compartment; and above the fire-pot is a heating-drum partially surrounded by a deflector-plate. The separation of the fuel-magazine from the heating part of the stove and other features effectively avoid the collection of gas.

CARD-GAME.—Edward Christie, Corning, N. Y. The inventor has devised a new card-game which consists of five suits and two extra cards, all designed after an entirely new plan. Various games can be played with these cards, the preferred rules being described in detail in the patent specification.

FIRE-PLACE.—Nathaniel Bates, Dubbs, Miss. This invention is an improvement in fire-places which are formed in flat plates, sections, or pieces secured together. The fire-place can be quickly and economically constructed, and, if desired, may be incased or inclosed at its back, sides, and upper portion by masonry, brickwork, or the like.

CANVAS-STRETCHER.—Arthur F. Tait, Yonkers, N. Y. The stretcher is extended and positively held in adjusted position through the medium of properly-applied keys. The corners of the stretcher are strengthened and maintained in proper shape. The central portion is braced; and the outer members can be expanded at such point in about the same ratio as the corners. A cardboard or strawboard is placed upon the front face of the stretcher, which affords an extended bearing for the canvas and a firm working surface for the artist.

FOUNTAIN-PENHOLDER.—Seneca M. and Elmer E. Salisbury, Aberdeen, S. D. Almost any pen can be inserted in this holder and can be used as if an ordinary holder were employed, without the annoyance of stopping to dip the pen into an ink-well or frequently to fill the reservoir as in the case of an ordinary fountain-pen. The fountain-pen is provided not only with a large reservoir for ink, but also with a convenient means whereby the reservoir may be filled in a cleanly manner and the ink supplied to the nib of the pen.

INKSTAND.—Charles W. Hanshaw, Lamar, Mo. The inkstand comprises a base and an ink-receiver provided with a dip-cup whereby the pen will receive only a proper amount of ink. Hence all the ink in the reservoir can be directed to and used up in the well forming a portion of the receiver. By a special pivotal mounting the receiver can be tilted toward the writer, so that the pen can be handily inked.

BREECH-LOADING FIREARM.—Frederick Hochbrunn, Manhattan, New York city. A controlling-ring or cut-off for magazine-rifles is provided, the ring being of such construction that it can be turned by the fingers to such a position that the cartridges in the magazine will not be affected when the extractor is brought into action. By means of this arrangement the arm, while the magazine is filled, can be used as a single loader. When the ring is brought to such a position that it will act upon both the extractor and the cartridges in the magazine, the gun can be used as a simple repeater. The ring is so arranged relatively to the bolt and the extractor, that it is carried out of engagement with the extractor and the cartridges, enabling the bolt to be withdrawn and the magazine replenished without withdrawing a cartridge.

Designs.

BREAD-BOARD.—Israel S. Thompson, Ashland, Wis. The board has a rim extending above its top and below its bottom, so that it can be used for making bread on both sides.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7987) F. W. Q. writes: A few months ago, I read an account in the Scientific American Supplement about renewing dry batteries by putting holes in the cell and immersing it in acidulated water. Would you please inform me the name of the acid and how proportion it with water? A. To renew a dry cell by the method referred to, pour one part of sulphuric acid into ten parts of water. Punch many holes in the outer coating of the dry cell as directed in the note referred to. When the liquid becomes cold, put it into any convenient glass or earthen jar, and place the prepared dry cell in the jar, so that the top stands out of the liquid about one inch. You now have a wet cell in place of the worn-out dry one, which will run till the acid has dissolved the zinc of the dry cell. This is the renewing of a dry cell. It changes the dry into a wet cell.

(7988) E. M. S. asks: Will you please send me the recipe for making the glue used on the backs of postage stamps. A. Gum dextrine, 2 parts; water, 5 parts; acetic acid, 1 part. Dissolve by aid of heat and add 1 part of 90 per cent alcohol.

(7989) W. G. asks: Will you please tell me if there is anything flexible that electricity will not burn? A. Asbestos.

NEW BOOKS, ETC.

MEMOIRS OF HAYWARD AUGUSTUS HARVEY. By His Sons. New York. Printed for Thomas W. Harvey, M.D., Orange, N. J. 1900. 12mo. Pp. 98.

The late Mr. Harvey was a typical inventor, and on the occasion of his death we published an elaborate biographical notice. The present memoirs compiled by his son give a thoroughly adequate idea of Mr. Harvey's epoch-making inventions. In addition to his process of treating armor plate, he also made many highly important inventions for making screws, spikes, wire nails, washers, etc. In all, Mr. Harvey had issued to him since 1859 seventy-eight patents, which is a most excellent record. The book is admirably written.

METHODS IN THE ART OF TAXIDERMY. By Oliver Davie. Philadelphia: David McKay. Pp. 359, 90 full page engravings. Price $2.50.

The work is very fully illustrated by engravings which vary a good deal in quality. There is hardly a branch of natural history which is more interesting than taxidermy and the excellent works on the subject have done much to aid taxidermists. Mr. Davie's book is a good one and shows an extensive practical acquaintance with the subject. The methods are modern and American.

STEAM ENGINE INDICATOR By Cecil H. Peabody. New York: John Wiley & Sons. 1900. 12mo. Pp. 153. Price $1 50.

The number of books upon the indicator is already very large, but there always seems to be room for a new treatise on this subject. The author is admirably fitted for his task, as he has the professorship of marine engineering and naval architecture at the Massachusetts Institute of Technology. The book is an excellent one.

MOULDERS' TEXT BOOK. Being Part II. of American Foundry Practice. By Thomas D. West. Eighth Edition. New York: John Wiley & Sons. 1900. 12mo. Pp. 461. Price $2 50.

The true test of the value of a technical book is to see whether it can run through a number of editions. The volume before us is certainly a most valuable contribution to technical literature. It is well illustrated by comprehensive engravings. The entire subject is well treated.

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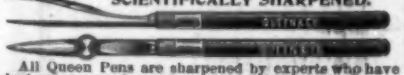

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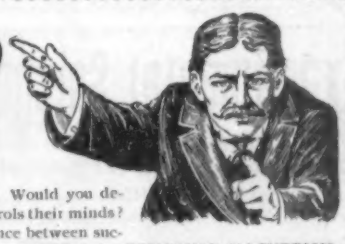

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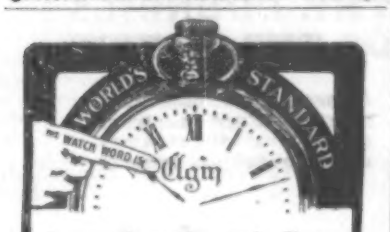

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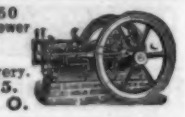

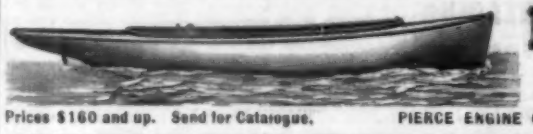

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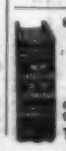

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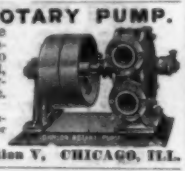

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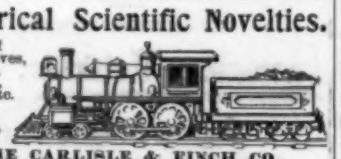

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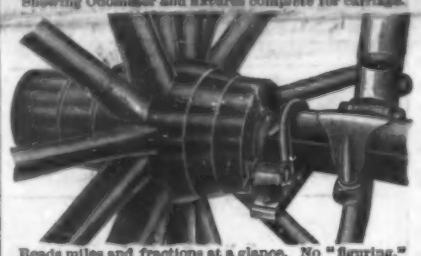

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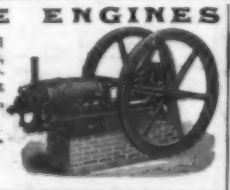

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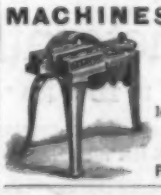

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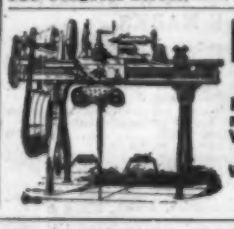

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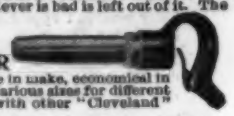

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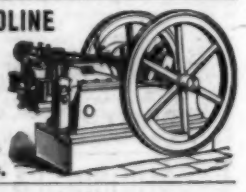

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